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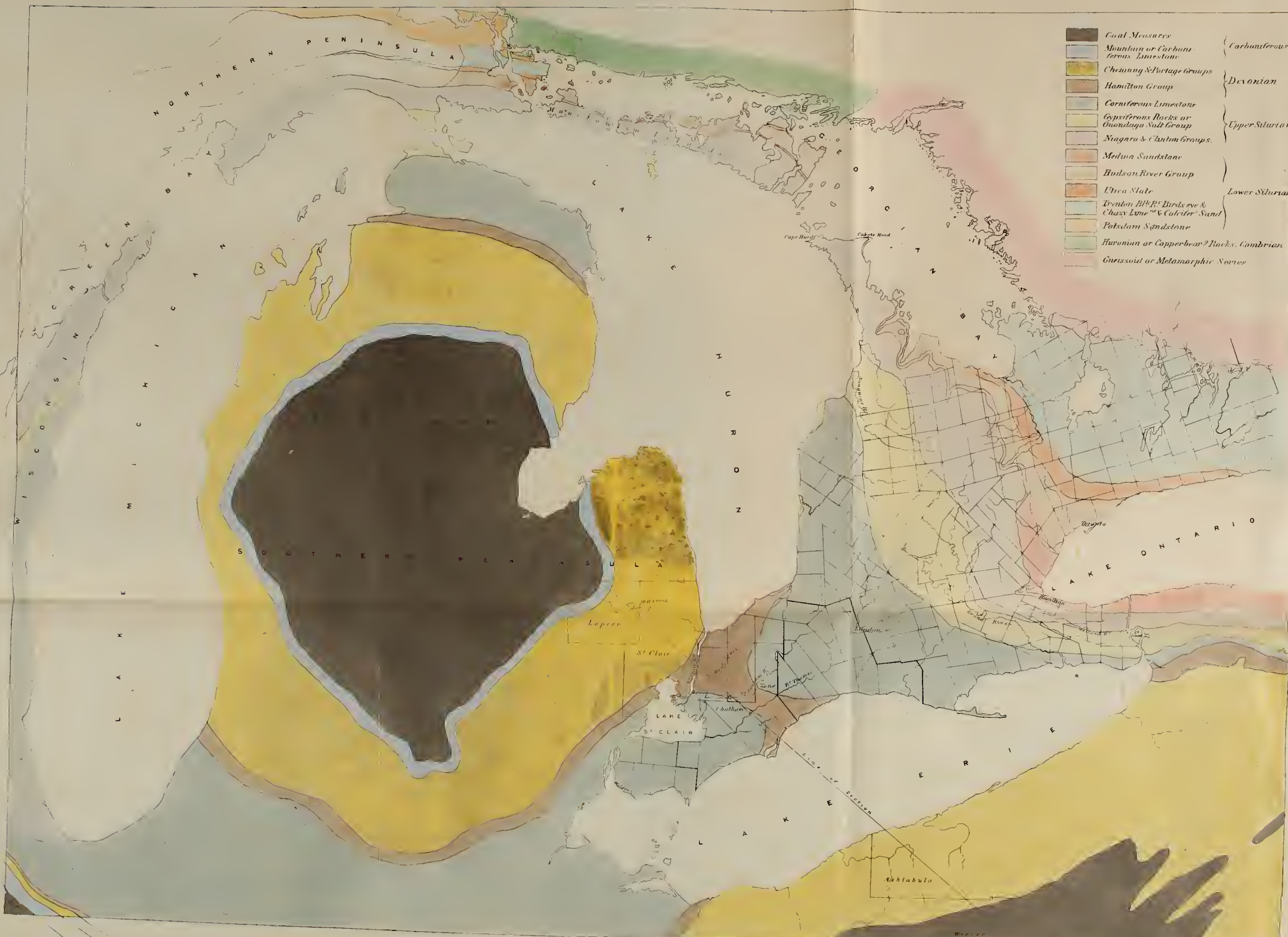

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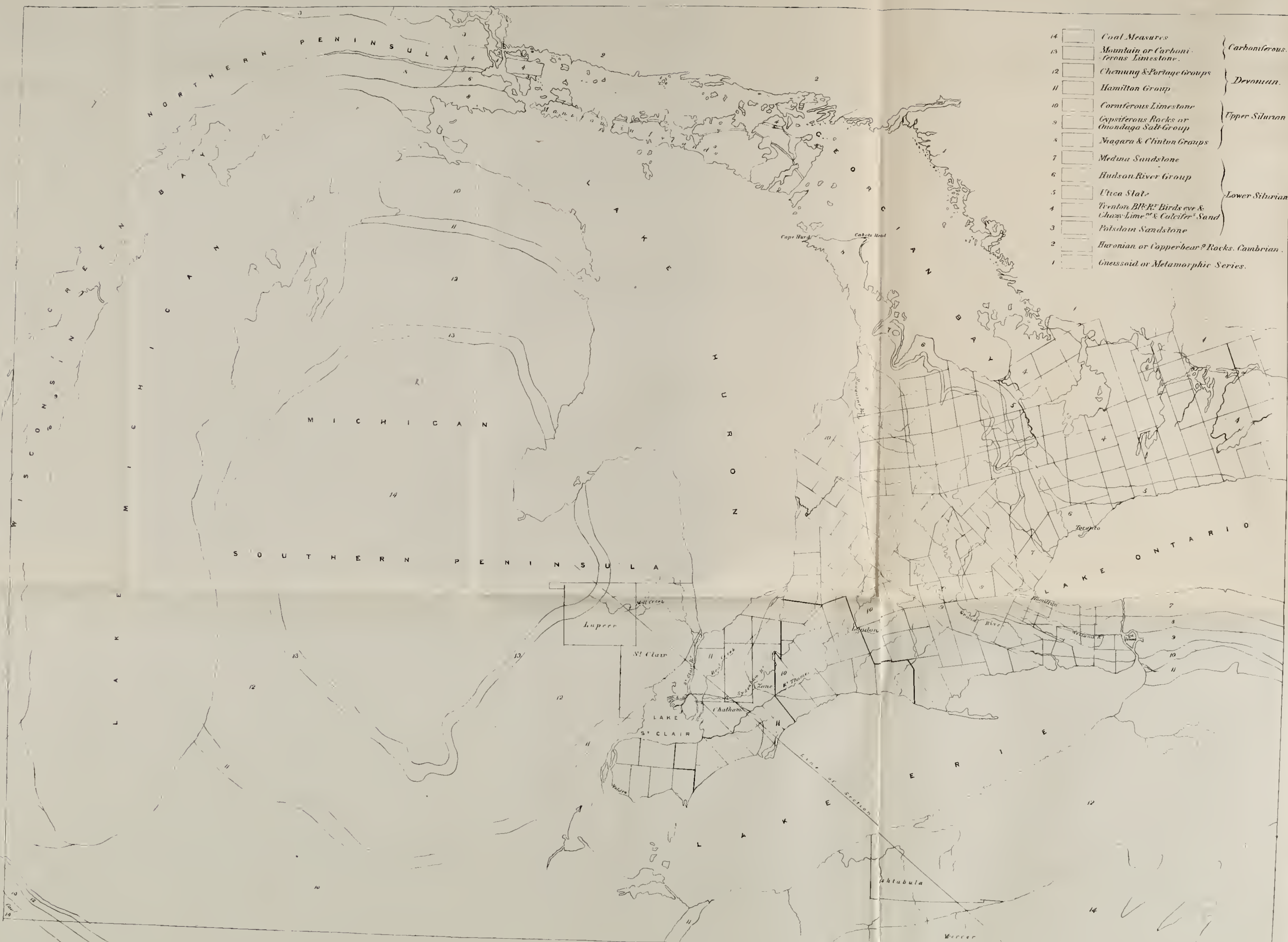

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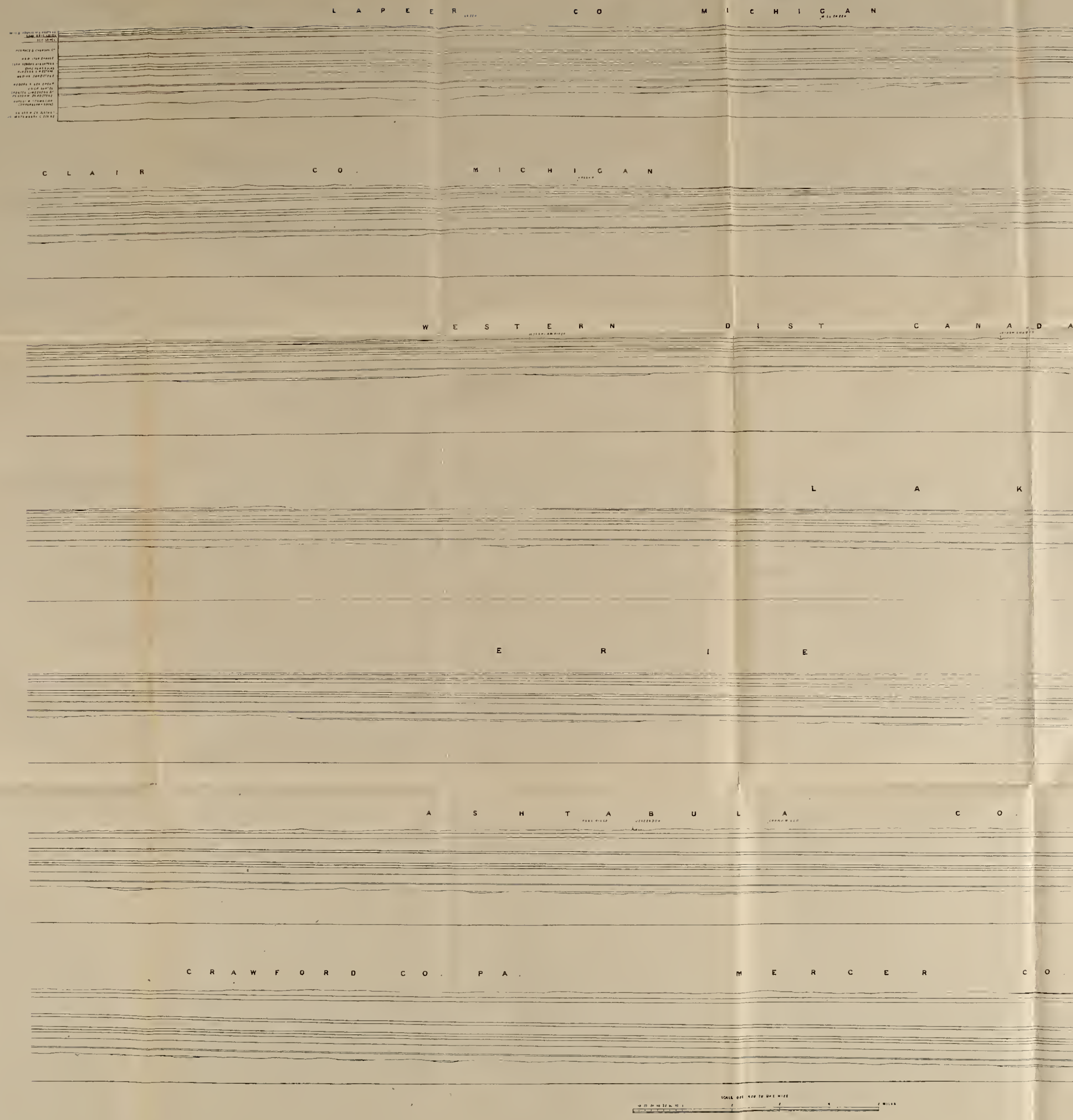

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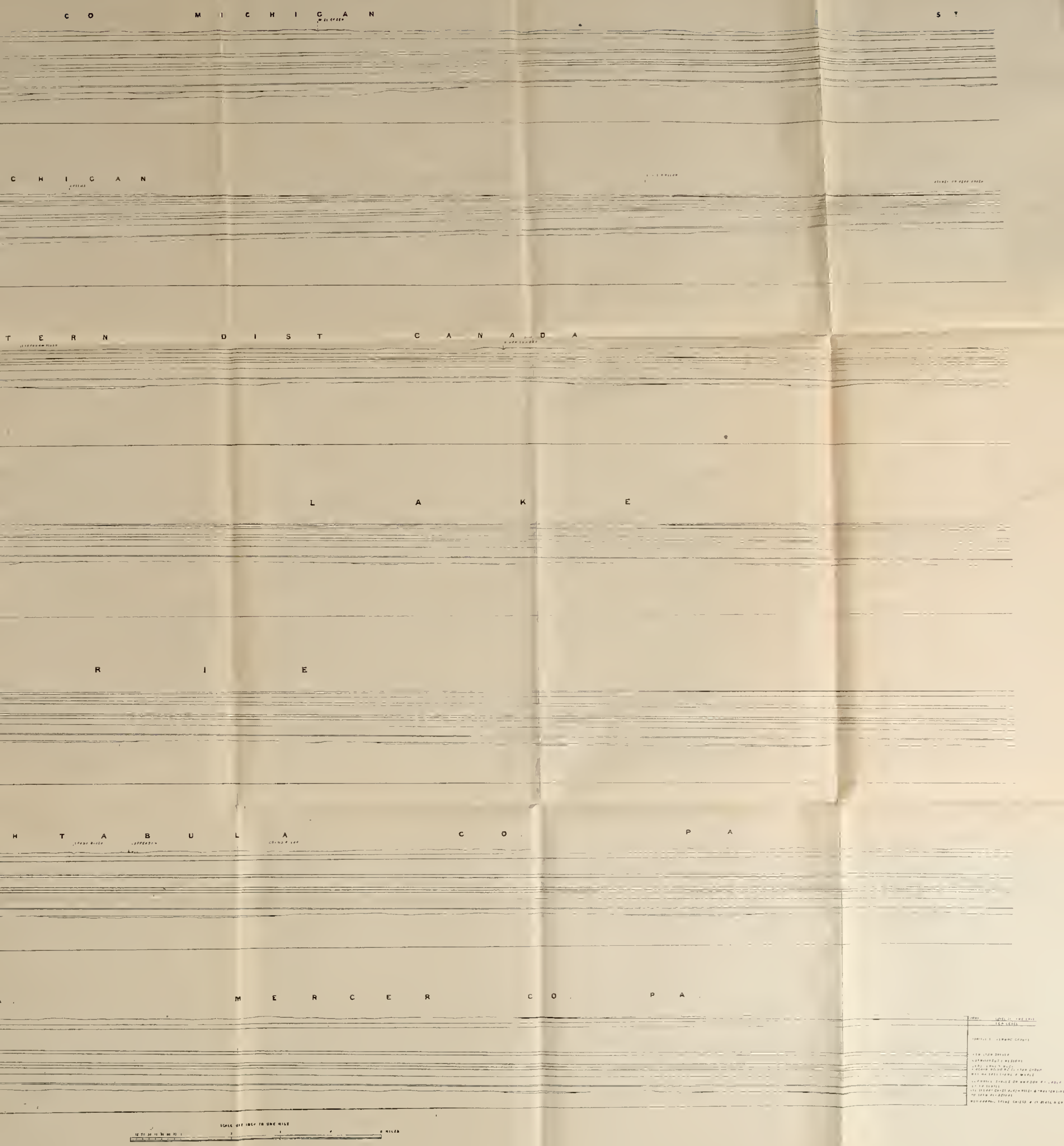

DIAGRAM OF THE GEOLOGICAL RESTORATIONS AT THE CHRYSTAL PALACE.

Chalk	Wealden		Oolite (Stonesfield Slate)	Lias		Lias	New Red Sandstone
Pterodactyle	Iguanodons	Hylæosaurus	Megalosaurus	Taleosaurus	Plesiosaurus	Icthyosaurus	Labyrinthodon

The Canadian Journal.

TORONTO, AUGUST, 1854.

On the Physical Structure of the Western District of Upper Canada.

By W. E. Logan, *F.R.S., F.G.S., and Director of the Geological Survey of Canada.*

The Western District of Upper Canada has, at a short distance on the north-west side of it, the coal-field of Michigan, and at a somewhat greater on the south-east, what has been called the coal-field of Appalachia. The former, as has been ascertained by the investigations of the geologists of the United States, occupies the chief part of the interior of the southern peninsula of Michigan, and has a superficies of about 12,000 square miles, while the latter, extending in length from the north-eastern corner of Pennsylvania to Tennessee, and in breadth from the vicinity of Lake Erie to the sources of the Potomac, presents the greatest known carboniferous area on the face of the globe, its surface being equal to about 60,000 square miles. The rocks of the Michigan coal-field, where they approach nearest to Lake St. Clair, and those of the Appalachian, where they do the same in regard to Lake Erie, exhibit an attitude so near to horizontality, that, without accurate admeasurements, it would not be easy to detect their dip. Those between the coal-fields and the two Lakes equally do so, and those again between the Lakes themselves are, as a whole, flatter still. The Western District, thus flanked on both sides by coal measures, and showing no easily observed reason in the dip why they should not be carried across it, might induce those who had made no careful examination of the matter to entertain a hope that some outlying patch of such measures might yet be found in that part of Canada. The ascertained structure of the District, however, shows that such a hope would be ill founded; and I propose to place before the Institute an explanation of what that structure is, illustrated by a map and section, that part of the map representing a portion of the United States being copied from the works of American geologists.

The rocks comprehended in the section in descending order are—

1. Gneissoid, or Metamorphic series.
2. Huronian, or Copper-bearing rocks, perhaps equivalent to the Cambrian of England.
3. Potsdam Sandstone.
4. Calciferous Sand-rock, Chazy, Birdseye, Black River, and Trenton Limestones. } Lower Silurian.
5. Utica Slates. } Lower Silurian.
6. Hudson River group. } Lower Silurian.
7. Medina Sandstone. } Lower Silurian.
8. Clinton and Niagara groups. } Upper Silurian.
9. Gypsiferous Rocks, or Onondaga Salt group. } Upper Silurian.
10. Corniferous Limestone.* } Upper Silurian.
11. Hamilton group. } Devonian.
12. Chemung and Portage groups. } Devonian.
13. Mountain or Carboniferous Limestone. } Carboniferous.
14. Coal measures. } Carboniferous.

It is not my intention to give any detailed description of these rocks, but for their mineral and fossil contents, as well as their respective thicknesses, refer to the various official reports presented to the government on the progress of the geological survey of the Province, and those of the geologists of the United States; nor shall I allude to their geographical distribution in detail farther than as occasion may require, the map being sufficient to explain it.

Taking these rocks in their general groupings, it will be perceived by the map that the Lower Silurian series, by a change in the strike from west to north-west, sweeps round from Lake Ontario to Georgian Bay, and proceeds thence by the north side of the Manitoulin Islands, and the north shore of Lake Huron, to the northern peninsula of Michigan, gradually curving to Green Bay, in Lake Michigan. The Upper Silurian follows them. The Niagara Limestone at the base aids in forming the neck of land separating and holding up Lake Erie from Lake Ontario, and continues in a ridge along the Blue Mountains, and the promontory terminating at Cabot's Head and Cape Hurd, of which promontory the chain of the Manitoulin Islands is only an interrupted prolongation. The Gypsiferous rocks succeed conformably, running from Grand Island, by the Welland and Grand Rivers, to the River Sauguine, while the superimposed Corniferous Limestone, from Lake Erie on the one side and Lake Huron on the other, is projected forward into the Western District as far as the Township of Zone. The same formation, with a projected form in an opposite direction, comes up from Ohio by the upper end of Lake Erie, and is carried north-easterly as far as the eastward side of Chatham. Between Zone and Chatham, the Hamilton group, composed of black bituminous shales, constitutes a narrow band, which runs north-westward towards Lakes Huron and St. Clair, and south-eastward to Lake Erie, gradually widening in both directions in the surface it occupies, and finally merging into two rings, or irregular circular belts, one of which is rudely concentric with the coal measures of Michigan, and the other with those of the Appalachian field—of which last, however, the map shows but a small portion. Within these two rings, thus united by the band across the Western District, and between them and the carboniferous centres, the Chemung and Portage groups occupy their place, in two broad and entirely separate zones, one of them showing itself north-west of Lake St. Clair, and the other south- east of Lake Erie.

To any one accustomed to consider the forms derived from the intersection of surfaces, who will carry in his mind that the various formations which have been given are nothing more than a set of thick, close-fitting, conformable sheets, which are intersected by the general surface of the country, it will be at once apparent that the ascertained geographical distribution of the formations results from the fact that between the Michigan and Appalachian coal-fields there is a flat anticlinal arch, the axis of which runs, with a gentle curve, from the upper extremity of Lake Ontario by London, Zone, and Malden, to the Maumé River, at the upper end of Lake Erie, and that between Chatham and Zone there is in it a slight transverse depression. This anticlinal arch is represented in the section, the line of which runs in a north-west and south-east direction from the one coal-field to the other, a little south-west of the Hamilton shales in Chatham. The section is given on a scale of one

* What is called the Corniferous limestone, under No. 10, is intended to represent whatever there may be in Canada of those deposits which, in the New York series of rocks, compose the Helderberg series, with the exclusion of the Onondaga Salt group; and, it may be here remarked, that the line of division between the Upper Silurian and Devonian rocks is given as merely approximative. The true position of this line seems as yet not quite certain, but it is supposed to be some where about the middle of that portion of the Helderberg series, which lies above the Onondaga Salt group.

mile to an inch, both horizontally and vertically; for it is only by using the same scale for both measurements that a true idea can be at once conceived of the very small slope in a set of strata that is required to produce important effects in geographical distribution.

It will be seen by the section that between the highest formation in the Western District (the Hamilton group) and the Carboniferous series, the rocks that are wanting (the Chemung and Portage groups) have a thickness of about 2500 feet, and without a very extensive area of these, there can be no reasonable expectation of coal.

The position of the great Lakes of the St. Lawrence, and the distribution of the rocks in connection with them, is one of the grandest aud most beautiful instances to be met with of the dependence of the geographical features of a country upon geological structure. Lake Ontario, Georgian Bay, with its continuance behind the Manitoulin Islands, and Green Bay, in Wisconsin, are excavations in the same formation of the Lower Silurian series. Lake Erie, Lake St. Clair, Lake Huron, and Lake Michigan are excavations in equivalent constituents of the Upper Silurian, while there runs a ridge separating these two sets of excavations from one another, which derives its main characteristic from the Niagara Limestone. The Chemung and Portage groups, which are composed chiefly of sandstones, have been strong enough to resist the denuding forces which have produced the excavations, and we find them forming equivalent limits to the Upper Silurian or perhaps more correctly, Devonian Lakes. It is thus the distribution of these various rocks, which is again dependent in a great measure upon the anticlinal arch running between the two great coal-fields, that gives to a very large part of Upper Canada its present geographical form.

Let us suppose that there was the smallest possible patch of the Carboniferous series in the Western District. What would be the result? It would be surrounded, of course, by the Chemung aud Portage groups. These would give around the carboniferous centre a broad ring of sandstone, which would reach as far as Malden to the south-westward, and London to the north-eastward, and the Western and London Districts, instead of being underlaid chiefly by calcareous, would be so by silicious rocks. The structure in connection with the coal-patch being sinclinal instead of anticlinal, the projected forms of the Corniferous limestone would be turned in the opposite directions to those they now have, and in Canada all the formations below would in succession be carried farther to the eastward. With the distribution of the rocks, the forms of the Lakes, dependent on this distribution, would be altered. The sandstones surrounding the coal-patch would extend, with the exception of the coal-patch, across from the Michigan to the Appalachian coal-field; and if like causes are to be supposed productive of like effects, one-half of Lake Erie and a part of Lake Huron would be obliterated, and the remaining portion modified in form. In short, the supposition of an acre of the true Carboniferous rocks existing in the Western District, requires as a consequence the supposition of a very extensive change in Upper Canadian geography.

If it be supposed that the coal-patch might be present through the influence of a dislocation, one of the conditions of such a dislocation must necessarily be that it must produce a downthrow on one side or the other of at least 2500 feet; and it would still be required that on the downthrow side the wide zone of sandstone, and all the circumstances consequent on it, should follow the coal until interrupted by the fault. But if disturbances had occurred in this part of America of sufficient force to produce a dislocation of this order, it is probable that it would not be a solitary one. The strata of the District would have been tilted up to various high angles, and instead of its flat surface, dependeut on the flatness of its rocks, the country would have presented a mountainous one.

Unless, therefore, workable coal seams are to be found in older rocks than those of the true carboniferous age, which no ascertained facts either in the United States or in Canada, or any other part of America, authorize us to expect, it appears to be a necessary consequeuce of the structure of the Western District that none will be met with there. But though there are uo true coal measures in the District, there are rocks which may readily be mistaken for such by observers, who unaware, when actual workable coal seams are not before the eye, how extensive an examination it may be expedient to make, and how many circumstances connected with geological structure it may be necessary to bring into harmony, before it is definitely pronounced whether a particular set of strata are likely to be associated with coal seams, are disposed to come to a hasty conclusion, founded upon mere mineral resemblances. These rocks are the black bituminous shales of the Hamilton group. They are no doubt nearly identical in mineral character with similar shales frequently found interstratified with true coal measures. Like them, they in several places hold so much bituminous matter as to give a partially inflamable character to the rock, and to yield petroleum or mineral oil. Not only do they resemble them in mineral character, but also in some degree in respect to a portion of their fossil contents. Coal measures are strongly marked by their fossil plants, and in the Hamilton shales are found *Calamites*, a genus abundant in the Carboniferous rocks, though the species may perhaps be different. These *Calamites* in the Hamilton shales, having lost their interior by decay, are found compressed into flat stripes and converted into crystalliue coal, as they generally are under similar conditions in true coal measures. The circumstances of the case, therefore, might occasionally deceive even practical observers, had they not other guides in the Crustacea and Mollusca of the formation, and a traced out and ascertained place for it in the order of superposition, in which by prior extended examinations its constituent strata had become known. It has been well ascertained by the geologists of the United States, that the place of these shales in Northern New York and Pennsylvania is about 2500 feet beneath the Carboniferous rocks; and before the institution of the State geological surveys, the formation had been very extensively and very expensively examined by boring, excavation, and surface explorations in search of coal seams, but of course without success; and it is with a view to aid in preventing a repetitiou of such useless expenditure in Canada that the present paper and its illustrations are submitted to the Canadian Institute.

On a method for preserving the sensitiveness of Collodion Plates for a considerable time.

By John Spiller and William Crookes.*

The extreme sensitiveness of Collodion as compared with paper and other photographic surfaces, renders this material invaluable in all cases where rapidity of action is desirable, but

*From the Philosophical Magazine.

up to the present time its use has been greatly restricted by the necessity for preparing the plate and completing the whole of the manipulatory details within a comparatively short space of time, thus rendering this beautiful process practically inapplicable in all cases where the conveniences of a photographic laboratory are not at hand.

For some time past we have been investigating the causes which operate to prevent the excited plate retaining its efficiency for more than a few hours. It seemed highly probable that the permanent sensitiveness of the film was principally dependent on the retention of a moist surface; and if by any artificial means this end could be secured, the original sensitiveness of the film would be, for at least a reasonable time, preserved unimpaired.

The only attempts up to the present time to effect this object are, we believe, that of M. Girod*, who proposes to enclose the sensitive collodion film between two plates of glass, with only so much of the exciting silver solution as might be retained by capillary attraction; and thus by retarding the evaporation of the water, to keep the surface moist, and consequently sensitive for a longer period; and secondly that of M. Gaudin†, who suggests the use of perfectly air-tight dark frames or boxes, in which a number of the wet plates could be arranged in a horizontal position, and there kept until required. Besides these two methods, it is well known that the plate will remain excited for a considerable time if kept immersed in a solution of nitrate of silver; in fact, a glass bath in the camera has been often used in cases where the length of exposure was likely to be too prolonged to admit of the plate being placed in the ordinary slide.

Instead, however of having recourse to a mechanical means for preventing the evaporation from the surface, we have endeavoured to avail ourselves of a chemical process, by the employment in the bath of substances having a powerful affinity for water; in the choice of these, however, we are necessarily limited to such as are neutral in constitution, and do not form insoluble compounds with silver. The nitrates and acetates, especially the former, seemed most convenient for our purpose on account of their general deliquescent nature, and for our first experiments we selected the nitrates of lime, magnesia, and zinc, as most promising of success. These agents were at first tried in the above-mentioned order; but from a few preliminary trials we were inclined to give the preference to the zinc salt, and having obtained such satisfactory results with its use, are induced to communicate them at once rather than withhold them until our investigation of the other compounds shall have been completed. At first we endeavoured to add the nitrate of zinc direct to the exciting bath, but the quantity required to prevent so large an amount of nitrate of silver from crystalizing out on the plate rendered the solution too dense to work with.

The following process can be recommended as having proved perfectly successful in our hands; we do not doubt that with more general use it may be considerably modified and improved, but at present we have rather contented ourselves with establishing the broad principle with such details only as will suffice to ensure good results, and to leave to a future period the consideration of those minor points which only a long experience can develope.

The plate coated with collodion (that which we employ contains iodide, bromide, and chloride of ammonium, in about equal proportions,) is made sensitive by immersion in the ordinary solution of nitrate of silver (30 grains to the ounce), and after remaining there for the usual time is transferred to a second solution of the following composition :—

Nitrate of zinc (fused) . . .	2 ounces.
Nitrate of silver.	35 grains.
Water	6 ounces.

The plate must be left in this bath until the zinc solution has thoroughly penetrated the film (we have found five minutes amply sufficient for this purpose, although a much longer time is of no consequence); it should then be taken out, allowed to drain upright on blotting-paper until all the surface moisture has been absorbed (about half an hour), and then put by until required. The nitrate of zinc, which is still retained on the plate is sufficient to keep it moist for any length of time, and we see no theoretical or practical reason why its sensitiveness should not be retained as long; experiments on this point are in progress; at present, however, we have only subjected them to the trial of about a week; although at the end of that period they were hardly deteriorated in any appreciable degree. It is not necessary that the exposure in the camera should be immediately followed by the development, as this latter process can be deferred to any convenient opportunity provided it be within the week. Previous to development, the plate should be allowed to remain for a few seconds in the original 30 grain silver-bath, then removed and developed with either pyrogallic acid or a protosalt of iron, and afterwards fixed, &c. in the usual manner.

The advantages of this process can scarcely be overrated.—Besides the facility it affords of working in the open air without any cumbrous apparatus, photography may now be applied in cases where it would have been hitherto impracticable, owing to the feebleness of the light *e.g.* badly illuminated interiors, natural caverns, &c.; if necessary, the exposure could be protracted for a week, or possibly much longer, and the deficiency of daylight compensated for by the employment of the electric or other artificial light. It will also be found useful where the plate must be kept ready excited, but the exact moment of exposure may depend upon possible contingencies rather than on the will of the operator, or in cases where it would be impracticable to prepare the plate just before exposure; for these reasons it might prove a valuable adjunct on the eve of a naval or military engagement, for accurately recording the positions of the forces.

A small proportion of nitrate of zinc added to the ordinary nitrate of silver bath in no way interferes with its action, and might obviate the inconvenience sometimes felt during hot weather in photographic rooms, of the film becoming partially dry before exposure. If added in a still smaller proportion to the silver solution used for exciting the ordinary Talbotype paper (without the employment of gallic acid), it is very probable that its sensitiveness may be preserved during a much longer period than is generally possible. As far as our experiments have gone, they tend to confirm this supposition; but at present we can hardly speak more confidently on this point, as it is still under investigation.

There are, no doubt, many other substances which might equally well answer the purpose of nitrate of zinc; besides those already mentioned, the nitrates of cadmium, manganese, and perhaps also those of copper, nickel, and cobalt might be found serviceable. Glycerine at first seemed to promise very good results, but the principal difficulty was the necessary impurity of the commercial product, in consequence of its being obtained from the exhausted leys of the soap boilers.

*Journal Phil. Soc. No. 9. †Ibid. No. 10.

Observations on a Telegraph Line between Europe and America.

By L. Turnbull, M.D.*

The magnificent idea of connecting Great Britain and the United States by telegraph, which has long been a favourite one with me, has been again revived in this country, and received much strength and encouragement from the investigations of the depths and condition of the bottom of the ocean, along the route of the merchantmen between Europe and the United States. According to a recent letter of Lieut. Maury's to the Secretary of the Navy, dated February 22, 1854, Lieut. Berryman availed himself of this opportunity to carry a line of deep sea soundings from the shores of Newfoundland to those of the Irish coast.

The result is highly interesting, as it bears directly, in so far as the bottom of the sea is concerned, upon the question of a submarine telegraph across the Atlantic, and I therefore beg leave to make it the subject of a special report.

This line of deep-sea soundings seems to be decisive of the question as to the practicability of a submarine telegraph between the two continents, in so far as the bottom of the sea is concerned.

From Newfoundland to Ireland, the distance between the nearest point is about 1600 miles;† and the bottom of the sea between the two places is a plateau, which seems to have been placed there especially for the purpose of holding the wires of a submarine telegraph, and of keeping them out of harm's way. It is neither too deep nor too shallow; yet it is so deep that the wires, but once laid, will remain for ever beyond the reach of vessels' anchors, icebergs, and drifts of any kind; and so shallow, that the wires may be readily lodged upon the bottom.

The depth of this plateau is quite regular, gradually increasing from the shores of Newfoundland to the depth of from 1500 to 2000 fathoms, as you approach the other side.

The distance between Ireland and Cape St. Charles, or Cape St. Lewis, in Labrador, is somewhat less than the distance from any point of Ireland to the nearest point of Newfoundland.

But whether it would be better to lead the wires from Newfoundland or Labrador, is not now the question; nor do I pretend to consider the question as to the possibility of finding a time calm enough, the sea smooth enough, a wire long enough, a ship big enough, to lay a coil of wire 1600 miles in length; though I have no fear but that the enterprise and ingenuity of the age, whenever called on with these problems, will be ready with satisfactory and practical solutions of them.

I simply address myself at this time to the question in so far as the bottom of the sea is concerned, and as far as that, the greatest practical difficulties will, I apprehend, be found after reaching soundings at either end of the line, and not in the deep sea.

I submit herewith, a chart showing the depth of the Atlantic, according to the deep-sea soundings, made from time to time, on board of vessels of the navy, by authority of the Department, and according to instructions issued by the Chief of the Bureau of Ordnance and Hydrography. This chart is plate XIV. of the sixth edition of Maury's Sailing Directions.

By an examination of it, it will be perceived that we have acquired, by these simple means, a pretty good idea as to the depression below the sea-level of that portion of the solid crust of our planet which underlies the Atlantic Ocean, and constitutes the basin that holds its waters.

A wire laid across from either of the above-named places on this side, will pass to the north of the Grand Banks, and rest on that beautiful plateau to which I have alluded, and where the waters of the sea appear to be as quiet and as completely at rest as it is at the bottom of a mill-pond.

It is proper that the reasons should be stated for the inference that there are no perceptible currents, and no abrading agents at work at the bottom of the sea upon this telegraphic plateau.

I derive this inference from a study of physical fact, which I little deemed, when I sought it, had any such bearings.

It is unnecessary to speak on this occasion of the germs which physical facts, even apparently the most trifling, are often found to contain.

Lieut. Berryman brought up with Brook's deep-sea sounding apparatus specimens of the bottom from this plateau.

I sent them to Professor Baily, of West Point, for examination under his microscope. This he kindly gave, and that eminent microscopist was quite as much surprised to find, as I was to learn, that all these specimens of deep-sea soundings are filled with microscopic shells; to use his own words, "not a particle of sand or gravel exists in them!"

These little shells, therefore, suggest the fact that there are no currents at the bottom of the sea whence they came—that Brook's lead found them where they were deposited in their burial place after they had lived and died on the surface, and by gradually sinking were lodged on the bottom.

Had there been currents at the bottom, these would have swept and abraded and mingled with these microscopic remains, the debris of the bottom of the sea, such as oaze, sand, gravel, and other matter; but not a particle of sand or gravel was found among them. Hence the inference that these depths of the sea are not disturbed either by waves or currents.

Consequently, a telegraphic wire once laid there, there it would remain as completely beyond the reach of accident, as it would be if buried in air-tight cases. Therefore, so far as the bottom of the deep sea between Newfoundland or the North Cape, at the mouth of the St. Lawrence, and Ireland is concerned, the practicability of a submarine telegraph across the Atlantic is proved.

The present state of Europe invests the subject of a line of telegraph wires across the Atlantic with a high degree of interest to the government and people of the United States. A general European war seems now almost inevitable; the attitude which this government will assume with regard to all the belligerent powers that may be involved in that war, is that of strict impartial neutrality.

The better to enable this government to maintain this position, and the people of the United States to avail themselves of all the advantages of such a position, a line of daily telegraph communication with Europe would be of incalculable service.

In this view of the subject, and for the purpose of hastening the completion of such a line, I take the liberty of suggesting for your consideration the propriety of an offer, from the proper source, of a prize to the company through whose telegraphic wire the first message shall be passed across the Atlantic.

From the above interesting and instructive letter, the following points are to be decided by the telegraphic engineer:—

1st. "To find a time calm enough, and a sea smooth enough to lay down a telegraphic cable." In my own mind, this first difficulty can be overcome as easily as the observations of Lieut. Berryman were made, if times of calm are found for such careful observations as he has made, by means of a twine string so as to let down a cannon ball of sixty-four pounds, and then raise a tube filled with the shells and earth of the depths of the ocean, we are almost certain a time calm enough and a smooth sea can be found to stretch a wire cable from land to land.

The second difficulty is, "a wire long enough." On this point we have accurate data to follow. The cable from Calais to Dover is 24 miles long, and consists of four copper wires, through which the electric currents pass, insulated by coverings of gutta percha. These are formed into a strand, and bound round with spun yarn, forming a core or centre, around which are laid ten iron galvanized wires of 5-16ths of an inch in diameter, each welded into one length of 24½ miles, and weighing about 15 tons per mile. The rope weighs altogether about 180 tons. It formed a coil of 30 feet diameter outside, 15 feet inside, and 5 feet high, and was made in the short space of 20 days, by a machine invented by Mr. George Fenwick, an engineer of the Leaham Harbour Iron Works in Durham.

* See Journal of the Franklin Institute,

† From Cape Freels, Newfoundland, to Erris Head, Ireland, the distance is 1611 miles; from Cape Charles, or Cape St. Lewis, Labrador, to ditto, the distance is 1601 miles.

The transatlantic cable, if the machinery is multiplied, and sixteen machines are employed, could, we have little doubt, complete the cable in six or seven months.

The third difficulty is, "a ship big enough." This can be no difficulty, for if one would not do, surely twenty would. What is the objection to sending it by trips or in pieces? Could it not be attached, as it was laid down, to a buoy? A vessel of 1000 tons could surely carry 400 tons of coil, for our cable would not exceed 12,000 tons.

Another important matter to be determined is, to what extent a galvanic current can be sent on an insulated wire. This has also been determined, for in favourable states of the atmosphere, lines in this country have been so insulated as to work in one circuit from 800 to 1000 miles.

In my work on the Telegraph, p. 152, I there state that the greatest distance that any of the lines had worked in one circuit, was from Boston to Montreal, *via* New York, Buffalo, and Toronto, a distance of about 1500 miles. This was done when the earth was frozen, and the lines insulated by frost.

The entire length of the telegraph line from New York to New Orleans, *via* Charleston, Savannah, and Mobile, is 1966 miles, and even this distance has been worked as one circuit by the aid of an instrument termed a connector, the effect of which is to cause one circuit to work the other through the entire series, thus producing a result similar to working through the entire line in one circuit.

As late as December 3, 1853, despatches were written direct through from New Orleans to Philadelphia and New York, on the National Telegraph line, the weather being cold and the earth frozen. In doing so, the only connector or repeater used was an insulated screw on the back of the register, invented by a distinguished telegraphic engineer, W. C. McRea, of this city, which is now the simplest mode employed; but this distance would require at least 30 Grove's cups, of a pint each, for every 100 miles, making about 480 cups, or 240 each side. I think this number of the battery of Mr. C. T. Chester would be amply sufficient. If a copper and zinc battery were employed, the number would have to be increased to about 30 to 40 cups every 100 miles, but even with this large battery, the expenses would be less than with the Grove's battery. In preparing the batteries, it is even possible to determine mathematically beforehand the amount of resistance and the force necessary to overcome it; and thus to proportion the number and size of the plates to the distance to which the wires extend. Large wires are better conductors than small ones. Copper is a much better conductor than iron; and as a thinner wire answers the purpose of conduction, it may be much more easily insulated.

The several conditions may all be calculated from the beautiful formula of Ohm.

In some recent experiments of Professor Faraday, that distinguished philosopher, by some of the results he obtained, has thrown much light upon the action of voltaic electricity in the submerged wire of the electric telegraph.

He first determines by actual experiment, that when copper wire is perfectly covered with gutta percha, so high is the insulation that in 100 miles of such wire, when fully charged by an intensity battery of 350 pairs of plates and submerged in water, the deflexion of a delicate galvanometer was not more than 5 degrees. The great perfection in the covering of the wire may be judged of by this fact alone. The 100 miles of wire was 1-16th of an inch in diameter; the covered wire was 4-16ths; the gutta percha on the metal was 0·1 of an inch in thickness. There could not be a better proof than this, that gutta percha is one of the best insulating agents we have, which fact I have before stated in my work on the Telegraph. He experimented with the subterraneous wires which exist between London and Manchester, and when they were all connected together so as to make one series, they made almost the distance as determined by Lieutenants Berryman and Maury between the Irish coast and Newfoundland, being 1500 miles, and having introduced galvanometers at intervals of about 400 miles, he found that when the whole 1500 miles were included, it required *two seconds* for the electric stream to reach the last instrument, which was placed at the end. In this instance the insulation was not as perfect, still the result shows that it will require a little over two seconds to cross the Atlantic by telegraph, which is about the rate of 750 miles in a second, which result is far below those obtained by the London and Brussels telegraph, which is stated at only 2700 miles in a second, even with a copper wire, while it will be remembered that Wheatstone, in 1834, with copper wire, made the velocity of the electric current 288,000 miles per second—a considerable difference.

The whole of this difference, according to Professor Faraday, depends upon the lateral induction of the wire carrying the current. "The production of a polarized state of the particles of neighbouring matters by a excited body, constitutes *induction*, and this arises from its action upon the particles in immediate contact with it, which again act upon those contiguous to them, and thus the forces are transferred to a distance. If the induction remain undiminished, then perfect insulation is the consequence; and the higher the polarized condition which the particles can acquire or maintain, the higher is the intensity which may be given to the acting forces. In a word, insulators may be said to be bodies whose particles can retain the the polarized state; whilst conductors are those whose particles cannot be permanently polarized." And in regard to long circuits, such as those described, their conducting power cannot be understood, whilst no reference is made to their lateral static induction or to the conditions of intensity and quantity which then comes into play.

The conducting power of the air and water wires are alike for a constant current. This, according to Faraday, is in perfect accordance with the principles and with the definite character of the electric force, whether in the static, or current, or transition state. When a voltaic current of a certain intensity is sent into a long water wire, connected at the further extremity with the earth, part of the force is in the first instance occupied in raising a lateral induction round the wire, ultimately equal in intensity at the near end to the intensity of the battery stream, and decreasing gradually to the earth end.

In the report of Professor Faraday, which is given in the *London Philosophical Magazine* for March, he there, in conclusion, refers to the terms *intensity* and *quantity*. These terms, he remarks, or equivalents for them, cannot be dispensed with by those who study both the static and dynamic relations of electricity. Every current where there is resistance, has the static element and induction involved in it, whilst every case of insulation has more or less of the dynamic element and conduction; and we have seen that the same voltaic source, the same current in the same length of the same wire gives a different result, as the intensity is made to vary with variations of

the induction around the wire. The idea of intensity, or the power of overcoming resistance, is as necessary to that of electricity, either static or current, as the idea of pressure is to steam in a boiler, or to air passing through apertures or tubes; and we must have language competent to express these conditions and these ideas.

In conclusion, I trust that a cable may be laid across the briny deep, and I am happy to find the matter taken hold of by intelligent and scientific telegraphic engineers, and its completion will be one of the wonders of the age. I have been recently informed that a company has been organized, styléd the New York, Newfoundland, and London Telegraph Company, whose object is the establishment of a submarine telegraph, to connect Newfoundland with Ireland. Peter Cooper, Esq., a telegraph wire merchant of New York, is the President, and Professor S. F. B. Morse is the Vice-President, with a number of Directors. One of the most active is Tal. P. Shaffner, Esq., a gentleman who has had considerable experience in submarine telegraph lines during the past five years, and who employed the following language in regard to the enterprise in the first number of a Journal of which he is editor:—"Tides may ebb and flow; the billows may surge with mighty power; the icebergs may tower their white mantled forms high in the skies, and sink deep in the briny sea; the heavens may let loose the loud rolling thunder, and the earth heave up its fiery lava; but just as sure as these elements of nature exist, and worlds revolve, America and Europe will be connected by an electric cord."

On a New Smoke-Consuming and Fuel-Saving Fire-Place,

With Accessaries Ensuring the Healthful Warming and Ventilation of Houses.

BY NEIL ARNOTT, M.D., F.R.S.

The great evils connected with the common coal fires are:—

1. Production of Smoke.
2. Waste of Fuel.
3. Defective Warming and Ventilation of Rooms.

We shall consider these in order:—

I. OF SMOKE IN THE INTERIOR OF HOUSES AND IN THE EXTERNAL ATMOSPHERE.

The proverb which declares a smoky chimney to be one of the greatest troubles of life, may suffice in relation to the interiors; in regard to the exterior, many particulars have to be noted. Examination of the question has ascertained that in London alone, on account of its smoke-loaded atmosphere, the cost of washing the clothes of the inhabitants is greater by two millions and a half sterling a year (that is, twenty-five times one hundred thousand pounds,) than for the same number of families residing in the country; and this is seen to be but a small part of the expense when we consider the rapid destruction of all furniture in houses, as of carpets and curtains, of articles of female apparel, of books and paintings, of the internal decorations, and even of the external surface of the stones of which edifices are built. For personal cleanliness it is necessary to be almost constantly washing the hands and face. Flowering shrubs and many trees cannot live in the London atmosphere, so that the charm of a garden, even at considerable distances from town, has almost ceased with the extension of the buildings and increase of smoke. A growing flower, if exposed to the atmosphere, is always covered with blacks or sooty dust, and defiles the hand which plucks or touches it. Sheep from the country, placed for a few days to graze in any of the parks, have soon a dingy fleece, strikingly apparent when others newly arrived are mixed with them. And this atmosphere, so damaging to inanimate things and to vegetable life, is inimical also to the health of man, as proved by numerous facts recorded in the bills of mortality. Many persons, with certain kinds of chest weakness, cannot live here. Many children brought from the country are seen soon not to be thriving. The coal-smoke then, may be called the great nuisance and opprobrium of the English capital.

II. OF WASTE OF FUEL.

Count Rumford, a writer of great authority in such matters, after making many elaborate experiments, declared that five-sixths of the whole heat produced in an ordinary English fire goes up the chimney with the smoke, to waste. This estimate is borne out by the facts observed in countries where fuel is scarce and dear, as in parts of Continental Europe, where it is burned in close stoves, that prevents the waste. With these a fourth part of what would be consumed in an open fire, suffices to maintain the desired temperature. I have myself made experiments here in London with like results. To save a third part of the coal burned in London alone, would save more than a million sterling a-year; and when coal is very dear, as during last winter, the saving would be much greater.

Then it is to be considered that coal is a part of our national wealth, of which, whatever is once used can never, like corn or any produce of industry, be renewed or replaced. The coal mines of Britain may truly be regarded as among the most precious possessions of the inhabitants, and without which they could never have attained to the importance in the world which the extraordinary developement of their mental and bodily faculties has now given them. It is enough to say that without coal they would not have had or used the steam-engine. To consume coal wastefully or unnecessarily, then, is not merely improvidence, but is a serious crime committed against future generations.

III. OF DEFECTIVE HEATING AND VENTILATING IN DWELLINGS.

Calling a thousand a week the average rate of mortality in London alone, it was found in the middle of last winter, that nearly 700 additional deaths occurred owing to the intense cold which then prevailed, and against which, evidently, the existing arrangements for warming and ventilating were insufficient. Not a little of the premature mortality at all times, and of the spread of epidemics, and of the low condition of health among the people, is, doubtless, owing to the same cause.

We shall now inquire whether it be or be not possible in a great measure to avoid the three great evils above described, and at the same time to secure other advantages.

I. SMOKE.

Is it possible to avoid or to consume smoke—in other words, to produce a smokeless coal fire?

Common coal is known to consist of carbon and bitumen or pitch, of which pitch again the elements are still chiefly carbon and hydrogen, a substance which, when separate, exists as an air or gas.

When the coal is heated to about 600 degrees Fahrenheit, the bitumen or pitch evaporates as a thick, visible smoke, which, when it afterwards cools, assumes the form of a black dust or flakes, called blacks, or smut, or soot. If that pitch, however, or pitchy vapour, be heated still more, as it is in the red hot iron retorts of a gas work, or in rising through a certain thickness of ignited coal in an ordinary fire, it is in great part resolved into invisible carburetted hydrogen gas, such as we burn in street lamps.

Now, when fresh coal is thrown upon the top of a common fire, part of it is soon heated to 600 degrees, and the bitumen of it evaporates as the visible smoke, which immediately rises. Of such matter the great cloud over London consists. If the pitchy vapour, however, be heated to ignition by the contact of a flame or of ignited coal near the surface, it suddenly becomes in a great part gas, and itself burns as flame. This is the phenomenon seen in the flickering and burning which takes place on the top of a common fire.

But if fresh coal, instead of being placed on the top of a fire, where it unavoidably must emit visible pitchy vapour or smoke, be introduced beneath the burning, red-hot coal, so that its pitch, in rising as vapour, must pass among the parts of the burning mass, it will be partly resolved into the inflammable coal gas, and will itself burn and inflame whatever else it touches. Persons often amuse themselves by pushing a piece of fresh coal into the centre of the fire in this way, and then observing the blaze of the newly-formed gas.

Various attempts, beginning, perhaps, with Dr. Franklin's, have been made to feed fires always from below, and so to get rid altogether of smoke. Another more recent one was made about thirty years ago, by an ingenious manufacturer in London, Mr. Cutler. He placed a box filled with coal under the fire, with its open mouth occupying the place of the removed bottom bars of the grate, and in the box was a moveable bottom, supporting the coal, by raising which the coal was lifted gradually into the grate to be consumed. The apparatus for lifting, however, was complicated, and liable to get out of order, which, with other reasons, caused the stove to be little used. The moveable bottom rested on a cross-bar of iron, which in moving was guided by slits in the side of the coal-box, and was lifted by chains at each end, drawn up by a windlass, and this windlass was turned by bevel wheels, of which one had to be moved by a winch in the hands of an attendant. Mr. Cutler was not aware that others had been engaged in the same pursuit, and took out a patent for his apparatus. A trial at law, however, afterwards decided that he had no patent right.

In the new fire-grate which I am now to describe, I have sought in every part the greatest possible simplicity which could give complete efficiency. The combination is represented in the wood-cut.—(in next number.—Ed.) The charge of coal for the day is placed in a box immediately beneath the grate, as shown in the diagram at the letters *e f g h*, and is borne upwards, as wanted, by a piston in the box, raised simply by the poker used as a lever, and as readily as the wick of an argand lamp is raised by its screw; the fire is thus under command, as to its intensity, almost as completely as the flame of a lamp. There are notches in the piston-rod for the point of the poker, and a ratchet catch to support the piston when the lever is withdrawn.

The coal-box of an ordinary fire may have a depth of seven or eight inches, which will receive from twenty to thirty pounds of coal, according to the area. In winter an inch or two more depth of coal may be placed over the mouth of the box before the fire is lighted, and in warmer weather the box will not require to be quite filled, that is to say, the piston at the time of charging needs not to be lowered quite to the bottom. If it become desirable on any account, as will happen with kitchen fires, to replenish the coal-box in the course of the day, it may be done almost as easily as to put coal on a common fire; thus, when the piston has been fully raised, so as to have its flat surface flush with the bottom bar of the grate, *e f*, a broad flat shovel or spade, of the shape of the bottom of the grate, is pushed in upon the piston, and it becomes at once a temporary bottom to the grate and a lid to the coal-box. The piston being then allowed to sink down to the bottom of the coal-box, the spade or lid is raised in front by its handle, and opens the box, so that a new charge of coal can be shot in. The spade being then withdrawn, the combustion goes on again just as in the morning. That the opening of this lid may be wider, the second bar of the grate is hinged, and yields to the upward pressure of the spade.

This fire is lighted with singular ease and speed. The wood is laid on the upper surface of the fresh coal filling the coal-box, and a thickness of three or four inches of cinder or coked coal left from the fire of the preceding day is placed over it. The wood being then lighted, instantly ignites the cinder above, and at the same time the pitchy vapour from the fresh coal below rises through the wood-flame and cinders, and becomes heated sufficiently to inflame itself, and so to augment the blaze. When the cinder is once fairly ignited, all the bitumen rising through it afterwards becomes gas, and the fire remains quite smokeless ever afterwards. A fire-place supplied with coal from below was used by a distinguished engineer in town for ten years, and the fact that his chimney had not to be swept in the whole of that time, proved that no soot was formed.

In the new grate, because no air is allowed to enter at the bottom of the coal-box,—for the piston-rod fits its opening pretty accurately—there is no combustion below, but only between the bars of the grate, where the fuel is completely exposed to the air, and near the mouth or top of the coal-box. The unsatisfactory result of some other attempts to make such a fire have been owing, in part, to the combustion extending downwards in the coal-box, because of air having been admitted below, and then consequent melting and coking of the mass of coal, so as to make it swell and stick, impede the rising of the piston.

A remarkable and most valuable quality of this fire is, its tenacity of life, or its little tendency to go out or be extinguished. Even after nearly all the coal in the grate, surrounded by the fire bars, has been consumed, the air will dive into the coal-box and keep the fire there gently alight, like a torch burning from the top downwards, until nearly the whole contents of the box are consumed, and thus the fire will remain burning for a whole day or night, without stirring or attendance, and yet at any moment it is ready to burn up actively when the piston is raised.

In certain cases, as during long nights, it may be desirable to ensure the maintenance of combustion with rather more activity, and for this purpose there is a slide in a small door at the front bottom of the coal-box, by which a graduated admission of air may be allowed. That door itself is open before

lighting the fire, to allow of the removal of any coal-dust or ash which has fallen down past the edge of the piston.

Before lighting the fire in the morning, the little ash which remains with this form of combustion is removed from off the piston.

The fire is extinguished at night by allowing it to exhaust itself, or by lifting out the few lumps of coke or caked coal which remain. The morning charge should be such that enough cinder or coke may be left for the smokeless lighting of the next day.

By the means now described, then, the first-named evil of the *production of smoke* is effectually combatted.

II. WASTE OF FUEL.

We now come to consider whether the *waste of fuel* which occurs in common open fires can be prevented.

Count Rumford, as the result of his own experiments already referred to, declared that 5-6ths of all the heat produced in a common open fire passed up the chimney with the smoke, and therefore to waste; and he appealed in corroboration to the experience of the Continent of Europe, where close stoves are used, which do not thus waste heat up the chimney, and where a much smaller allowance of fuel than is here needed in open fires suffices. I have, in my own house, a striking illustration of the matter in a peculiar enclosed fire, which, for fourteen years past, in a large dining-room, has maintained, day and night, from October to May, a temperature of 60 degrees or more, accompanied with good ventilation, by an expenditure of only 12lbs. of coal for 24 hours, or about a fourth of what would be used in an open fire burning for 15 or 16 hours. This fire is lighted about the beginning of October, and is not extinguished at all until the following May. The aperture by which the fresh air enters the stove to maintain the combustion sufficient to warm that room, is about three-quarters of an inch in diameter. If this be compared with the aperture of a common chimney-pot, which has a diameter of ten inches, and an area or size 150 times greater than my stove, and one thinks of the rapidity with which a column of dense smoke filling that pot escapes from it when the fire is burning briskly; and reflects further that such column consists entirely of the warmest air from the room, blackened by a little pitchy vapour from the fire, there is proof of prodigious waste, and room for reasonable hope that a saving is possible. To see how a saving may be effected, the exact nature of the waste in such cases has now to be explained:—A single mouthful of tobacco smoke, on issuing immediately diffuses itself so as to form a cloud larger than the smoker's head, and soon would contaminate the whole air of a room, as would also the smoke and smell of wood, paper, or or combustible burned in a room. Now, the true smoke of a common fire is not the whole of what is seen issuing from the chimney top, but only little driblets or jets which shoot up or issue from the cracks in the upper surface of coal which forms the fire. These jets, however, quickly diffuse themselves, like the tobacco smoke, in the air around them, that is to say, in the large volume which fills the space left over a common fire, and over the hobs, if there be such, at the side of the grate. The whole of the air so contaminated, and which may be in volume 30, 50, or 100 times greater than that of the true smoke, is then all called smoke, and must all be allowed to ascend away from the room. It is evident, then, that if a cover or hood be placed over a fire, such as is represented by the letters *y a b* in the diagram, so as to prevent the diffusion of the true smoke or the entrance of pure air from around to mix with it, except just what is necessary to burn the inflammable gases which rise with the true smoke, there would be a great economy. This has been done in the new fire-place, with a saving of from one-third to one-half of the fuel required to maintain a desired temperature. In a room the three dimensions of which are 15 feet, 13½ feet, and 12 feet, with two large windows, the coal burned to maintain a temperature of 55 degrees in the coldest winter days, has been 18 lbs. for 19 hours, or less than a pound per hour.

And it is to be remarked that not nearly the whole possible saving has been effected in the case referred to; for the grate was an old one imperfectly altered, and as the true smoke, little diluted, is very hot air when it leaves the ignited coal, and if it were made to pass, in contact with a vessel containing water or colder air, it would give up for use a considerable part of its heat. In many cases such saving will be profitably effected. Under the present imperfect forms of open fire, the whole of the hot smoke passes away as certainly as here, but at present is so much diluted with the colder air of the room, that ordinary observers do not perceive, and, consequently, do not regret the fact.

In many cases the contraction of the space over the fire will be more conveniently made in brick-work than by a metallic hood. Where the hood is used, unless it be made a boiler or water-vessel, it should be lined with tile to prevent that overheating which would cause in the room some smell of heated metal.

The stalk of the hood at *y* passes closely through a plate or other stopping at the bottom of the chimney, so that no air shall enter the chimney but through the hood; and there is a throttle-valve or damper in the hood-stalk, at *t*, giving perfect control over the current of air that passes through. No part of the apparatus is more important than this valve or damper, and its handle or index must be very conspicuous, and have degrees of opening marked on its plate as clearly as the points are marked on a compass-card. When the valve is quite open, the chimney acts to quicken the combustion, like that of a blast-furnace, or like a forge-bellows, but, by partially closing the valve, the current may be diminished, until only the most tranquil action remains. The valve should not be open in general more than just enough to let all the burned air or thin smoke, which is scarcely visible, pass through. When the valve is once adjusted to the usual strength of chimney action, it requires little change afterwards.

In many cases it is desirable to be able to command and modify, by a movable plate, the size of the front opening of the hood or fire-place, as well as the opening of the chimney throat. By the proper adjustment of the two, the desirable brightness of the front of the fire may be maintained.

The chimney-flue above the upper opening of the hood should have its sides made slanting, so as not to harbour dust or any soot which, from any careless use of the fire, might be produced. The size of the chimney-flue is not important.

The answer then to the second question, as to the possibility of saving fuel, is by the facts here adduced, given in the affirmative.

(To be continued.)

On Visual Education as applied to Geology.* With Plate.

It has been truly said, that the highest function of the Society of Arts must be its endeavour to promote the general advancement of education; and in the belief that such are the practical views of this Society, I presume that its members cannot view with indifference any part of that great undertaking at the Crystal Palace, which may be so justly called a grandchild of the Society of Arts. It was here that the Great Exhibition of 1851 first saw the light, and, under the happy auspices of our Royal President, was brought to maturity—a giant born of peace and good-will to men; of such parentage how much is to be hoped for!

In this the 100th year of our existence as a Society, it is most happily conceived to lay before the whole world an exhibition of all the materials of education collected from all nations; therefore, in the hope that you will consider my attempt at least seasonable, I shall endeavour, very briefly, to lay before you this evening a slight sketch of part of one of those great efforts, in an educational direction, which the Crystal Palace Company are making for the benefit of their fellow-men of all classes; and no less is it a benefit to their fellow-men because it is being done commercially, which, if properly analysed, will be found to be the most truly independent system and most congenial to the feeling of every right-minded Englishman.

The whole of the great scheme now working to completion, known as the Crystal Palace, might be properly described as one vast and combined experiment of visual education; and I think it would be easy to show that its educational powers and design constitute its legitimate claims to the support of all civilized Europe; but like its great parent, the Exhibition of 1851, it is too extensive to allow of even a short catalogue in a brief space of one hour; I therefore confine myself to a hasty sketch of part of the attempt to apply the active principle of teaching directly through the eye that branch of the truths of creation upon which I have been engaged for the last year and half.

This direct teaching through the eye has been recognized as a principle and a facility of education for some years past, even in the limited sphere of schools; and I believe the name of Pestalozzi deserves the most honorable mention in connection with its first enunciation as a recognized facility upon principle. His, and his followers' lessons on objects were urged upon the public some twenty years ago, and a writer who was quoted at the time, in support of the principle, shrewdly observed, that "we daily call a great many things by their names, without even inquiring into their nature and properties, so that in reality it is only only their names, and not the things themselves, with which we are acquainted." If this remark was and is still applicable to our superficial knowledge of every-day objects, how much more literal it becomes when applied to that branch of science and truth (for science is only a synonyme for truth) which the Crystal Palace Company have so boldly undertaken to lay before the multitude; there we shall reverse that order of teaching which is described as the names and not the things with which we become acquainted: it will be the things with their names that we shall present to the people; and not only the people in the restricted sense of the word, but to the million, including the well-informed and those above the average in education and acquirements; to the majority of these the geological restorations will present all the novelty of a first acquaintance, for, with reference to the true form and size of the extinct animals, little more than the name was known to many who had an earnest desire to acquire some knowledge of geology, but whose scanty leisure would not allow of their pursuing their inquiries sufficiently far to realize that life-like interest which becomes almost essential for the successful continuance of any pursuit. Our natural sympathies are with life. That which does or has lived will always be found to interest far beyond any inorganic object, however brilliant or beautiful.

Of course it is not my intention to offer you on the present occasion a lecture on Geology or Palæontology, but only simply to describe, in a few words, the foundation upon which I have constructed and restored these great animals, and how I have obtained that truth and accuracy which may entitle my restoration of the extinct animals to be viewed as useful and trustworthy lessons to all classes, and which we hope will render the appearance and names of the ancient inhabitants of our globe as familiar as household words.

Geology and Palæontology, though deeply interesting to all who have had the opportunity for study, have hitherto been restricted to the professed anatomist, or to those whose great resources enabled them to make collections and to bring around them the costly requisites of their enthusiastically followed pursuits. Sir Philip Egerton, Lord Enniskillen, Sir Roderick Murchison, Mr. Bowerbank, and other distinguished names, illustrate the limited number to whom the study of Geology and Palæontology was practically within reach. We have public museums, it is true, but even our national collection at the British Museum, though containing some of the finest fossils that have been collected throughout the world, from their detached state, there being only two or three skeletons for comparison, offers little more than objects of wonder, literally only dry bones or oddly-shaped stones to the majority who see them. The inevitably fragmentary state of such specimens of course left much to the imagination, even to those who looked at them with some little knowledge of comparative anatomy, and as that amount of knowledge is not found among the average acquirements of the public at large, it was a fallow field, which nothing less than the great enterprise and resources of the Crystal Palace Company could have attempted for the first time to illustrate and realise—the revivifying of the ancient world—to call up from the abyss of time and from the depths of the earth, those vast forms and gigantic beasts which the Almighty Creator designed with fitness to inhabit and precede us in possession of this part of the earth called Great Britain.

Geology has been aptly called the science of nature's antiquities, for, however fresh, renewed, and vigorous in all her operations, yet even nature has had her olden time; her early days must have seen fierce struggles, contentious storms, fire and water, like the modern theories, struggling for the mastery; then her epoch of calmer subsidence and gentler rule, each state leaving its indestructible monuments, with their carvings and inscriptions for man to decypher. Nature's pyramids are mountains of granite, slate, and limestone; her aquaducts majestic rivers, leaving gigantic boulders for land-marks; but more to our immediate purpose, the geologist, like the modern antiquarian, finds his richest stores of information in nature's cemeteries, where the bones of byegone generations lie embalmed with proof of how they lived and where they died.

* Illustrated by Diagrams and Models of the Geological Restorations at the Crystal Palace. By B. Waterhouse Hawkins, F.G.S., F.L.S. —*Journal of the Society of Arts.*

The science of Palæontology, or as the literal translation of the name indicates, the study of ancient beings, treats of the history of fossils; and its principal end is to make known the forms and the zoological relations of the beings which have inhabited the globe at divers epochs anterior to our own. It has also to fill one of the most remarkable pages in the history of the earth, by retracing the successive phases of the organization of the animals that have peopled it. It has two principal applications—1st, to Zoology, by making known those new or rather unknown forms and conditions of existence which are often wanting in living nature. It may sometimes, by offering new transitions, demonstrate natural relations of which we were ignorant; it re-acts also upon the general laws of comparative anatomy, and has contributed much to its researches and discoveries, and it is connected with all the questions relative to the origin and development of organized beings. 2dly, to Geology—Palæontology again applies to geology, by furnishing the only certain basis for the determination of the stratified earths, and by clearing up several essential points relative to the ancient limits of seas and continents. The study of fossils is destined to throw a great light upon the determination of the order of succession of the beds or strata, and of their relative age. The study of fossils may also enlighten questions of detail. Certain sorts of fish and of mollusca are known to be essentially belonging to rivers, and others to inhabit the seas. If the fossils of an earth belong to the fresh water species, we may legitimately conclude that such earth has been deposited by rivers or by lakes of fresh water. If, on the contrary, the beings that have there left their remains belong to the marine species, it may be presumed that such deposit owes its origin to the waters of the sea.

In latter years fossils have revealed remarkable facts concerning the state of the globe at various epochs. Some authors have sought to make use of them to define the shores and the configuration of the ancient seas; at least, we know that in the deep sea we find fewer molluscs than near the coasts: the depth and absence of vegetation cause the greatest part of the species to avoid the centre of the seas; the shores, on the contrary, which furnish a more abundant nourishment, and the rocks near the surface, serve as shelter to a much larger number of individuals. The presence of numerous fossils, and, above all, that of species which belong to the kinds essentially fluviatile, may then serve to indicate the shore of ancient seas, whilst rare fossils of species from the deep seas prove, on the contrary, that the earths where they are deposited have been formed far from the coasts of seas at divers epochs. Thus it will be seen that geology would be but a barren study without some knowledge of the fossil remains of those beings who apparently first peopled the waters of the earth.

An inspection of the various strata in which fossil remains have been deposited serves to prove that, in general, a constant order has existed in their formation. The sea, by which the entire earth appears to have been covered, having rested in certain situations a sufficient length of time to collect particular substances, and to sustain the life of certain genera and species of animals, has been afterwards replaced by another sea, which has collected other substances, and nourished other animals, whose remains are found in each stratum, and are generally limited to one formation, or, if reappearing in a successive stratum, much modified in size or structure. I have prepared here a diagram. which will give you an idea of the succession of epochs; each epoch containing a succession of periods and formations, which, though often found to have been disturbed by some vast convulsive force, can yet be retraced to its natural order of succession and super-position.

The diagram shews those formations which constitute the secondary epoch, or, if described in ascending order, the commencement of that vertebrate existence which left unequivocal evidence of its inhabiting the earth, by leaving the imprint of its footmarks, which, at one time, was all we knew of the extraordinary inhabitants of the New Red Sandstone, when it was called Chirotherium, from the hand-like shape of the foot-marks, until the mighty genius of Professor Owen placed the teeth and head before us, with such indisputable characters as united them to the footmarks, and thus, by induction, the whole animal was presented to us.

Next, in ascending succession, we have tho Tethyosaurus, Platyodon, Tenuirostris, and Cummunis, the Plesiosaurus Dolichodirus, as restored by Dean Conybeare, the Plesiosaurus Macrocephalus and Hawkinsii, the latter named by Professor Owen after Mr. Thomas Hawkins, who with great enthusiasm cleared it from its matrix of Lias, and made the first great collection of fossils of the Lias which were purchased by the trustees of the British Museum, where they are now, and form the most striking features of the national collections of fossils.

It next illustrates the upper portion of the Lias, sometimes known as the alum shale, so well developed at Whitby, in which remains of the Teleosaurus have been so frequently found. This animal will be recognised by its near resemblance to the crocodile of the Ganges called Gavial, or Garrial, as it should be called: to the casual observer the principal difference consists in its greater size. The next formation above the Lias is the Oolite, of which at present that singular reptile, the Pterodactyle, represents the inhabitants, while the intermediate formation, called the Stonesfield slate, bears the great discovery of Buckland, the Megalosaurus, or the great lizard. This, the upward strata of the great Oolite, brings us to the formation called the Wealden, which Professor Owen, in one of his elaborate descriptions of the British fossil reptiles, calls the metropolis of the Dinosaurian order, which I have here represented by the best known and most typical species, the Hylæsaurus or lizard of the mud, with its extraordinary dermal covering and long range of dorsal scutes, of which the bones were found by the late Dr. Mantell, whose persevering researches in Wealden formations first gave the idea to science of the former existence of the Iguanodon.

These restorations of the Iguanodon I made from the measurements of the great Horsham specimen, as the largest is called, from its having been found and carefully preserved by Mr. Holmes, surgeon, at Horsham, who has bestowed much care and attention on the development of the great fossils found in his neighbourhood, among which are the largest known specimens of the bones of Iguanodon, having also the greater value of being found altogether, evidently belonging to one individual. These he kindly placed at my service for comparison with the better known Maidstone specimen now in the British Museum, which was so admirably extricated from its matrix and preserved by Mr. Beusted.

This Iguanodon was the animal the mould of which I converted into a *salle a manger*, and in which I had the honour of receiving Professor Owen, Professor E. Forbes, and twenty of my scientific friends to dinner on the last day of the year 1853. This circumstance will best illustrate the great size of these animals, the restoration of which has involved some of the greatest mechanical difficulties that can come within

the sculptor's experience: and, if it will not be considered out of place, I will briefly state the process by which I have constructed these large models.

In the first week of September, 1852, I entered upon my engagement to make Mastodon or any other models of the extinct animals that I might find most practicable; such was the tenour of my undertaking, and being deeply impressed with its important and perfectly novel character, without precedent of any kind, I found it necessary earnestly and carefully to study the elaborate descriptions of Baron Cuvier, but more particularly the learned writings of our British Cuvier, Professor Owen. Here I found abundant material collected together, stores of knowledge, from years of labour, impressing me still more with the grave importance of attempting to present to the eye of the world at large a representation of the complete and living forms of those beings, the minutest portion of whose bones had occupied the study and research of our most profound philosophers; by the careful study of their works, I qualified myself to make preliminary drawings, with careful measurements of the fossil bones in our Museum of the College of Surgeons, British Museum, and Geological Society; thus prepared I made my sketch-models to scale, either a 6th or a 12th of the natural size, designing such attitudes as my long acquaintance with the recent and living forms of the animal kingdom enabled me to adapt to the extinct species I was endeavouring to restore. These sketch models I submitted in all instances to the criticism of Professor Owen, who with his great knowledge and profound learning most liberally aided me in every difficulty. As in the first instance it was by the light of his writings that I was enabled to interpret the fossils that I examined and compared, so it was by his criticism that I found myself guided and improved, by his profound learning being brought to bear upon my exertions to realise the truth. His sanction and approbation obtained, I caused the clay model to be built of the natural size by measurement from the sketch-model, and when it approximated to the form, I with my own hand in all instances secured the anatomical details and the characteristics of its nature.

Some of these models contained 30 tons of clay, which had to be supported on four legs, as their natural history characteristics would not allow of my having recourse to any of the expedients for support allowed to sculptors in an ordinary case. I could have no trees, nor rocks, nor foliage to support these great bodies, which, to be natural, must be built fairly on their four legs. In the instance of the Iguanodon, it is not less than building a house on four columns, as the quantities of material of which the standing Iguanodon is composed, consist of 4 iron columns 9 feet long by 7 inches diameter,

600 bricks,
650 5-inch half-round drain tiles,
900 plain tiles,
38 casks of cement,
90 casks of broken stone,

making a total of 640 bushels of artificial stone.

These, with 100 feet of iron hooping and 20 feet of cube inch bar, constitute the bones, sinews, and muscles of this large model, the largest of which there is any record of a casting being made.

I have only to add that my earnest anxiety to render my restorations truthful and trustworthy lessons has made me seek diligently for the truth and the reward of Professor Owen's sanction and approval, which I have been so fortunate to obtain, and my next sincere wish is that, thus sanctioned, they may, in conjunction with the visual lessons in every department of art, so establish the efficiency and facilities of visual education as to prove one of many sources of profit to the shareholders of the Crystal Palace Company.

On the Spheroidal State of Bodies.

By Arthur H. Church, Esq.—*To Dr. Tyndall, F.R.S. &c.**

The successful method by which, in your last lecture, the existence of a space between water in the spheroidal state and the containing vessel was proved by the complete interruption that space offered to the passage of a galvanic current, has induced me to devise a few experiments on the subject.

I have to describe in the present communication, in the first place, some experiments, I have just performed for the purpose of obtaining decisive evidence of the isolation of all bodies in the spheroidal state from the surfaces on which they roll; and in the second place, to offer a few suggestions as to the probable causes of the phenomena under consideration.

It was found by Boutigny, that if into a clean, red-hot platinum capsule acids and alkalies be placed, the acid and alkaline liquids will roll about, repelling one another violently. This, though an interesting example of the suspension of chemical affinity, does not prove the existence of a space between the platinum vessel and the spheroids.

The first experiment I have to mention was this;—I took a copper basin, three inches in diameter and rather more than half an inch deep, polished its concave surface, and covered it with a thin film of silver by the galvanic process. The plated basin was now brought to a very high temprature, and while thus heated, a few drops of a slightly alkaline solution of sulphide of sodium were poured into it. These drops instantly assumed the spheroidal form and rolled about, making, however, no mark or track upon the silver. The source of heat was now withdrawn: the temperature was soon so far reduced that the liquid exhibited its normal properties, the space between it and the silver no longer existed, and a black stain of sulphide of silver covered the dish.

Another instance of the assumption of the spheroidal state has been often noticed. It occurs when ether is placed on the surface of boiling water. Now, if a fixed inorganic acid be dissolved in ether, and the water be coloured with litmus, no reddening of the latter will take place as long as the ether remains in the spheroidal state. The acidulated ether and the tinted water cannot, therefore, be in communication; they are separated by a film of air or of vapour.

I pass on to notice in as few words as possible the remainder of my experiments. I have remarked that in certain circumstances spheroidal globules form upon the surface of liquids during the processes of filtration and distillation. The phenomenon to which I refer is exhibited by many liquids, more frequently and conspicuously perhaps by those that are the more volatile. I have observed it with alcohol, water, aqueous and alcoholic solutions, syrup, with essential oils and many other organic substances. I have sometimes, however,

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* From the Lond. Edinb., and Dubl. Philosoph. Magazine, April, 1854.

found considerable difficulty in its reproduction, and will, therefore, describe in detail a method which is applicable in most cases for obtaining in this manner an example of the spheroidal state. We will employ a particular instance. If we take cymole, a hydrocarbon belonging to the benzole series, and half fill a bottle two or more inches in diameter with it, placing in the neck of the bottle a perforated cork through which passes a funnel-tube filled with cymole, and having a piece of sheet India-rubber stretched over its mouth, we shall find that on adjusting the funnel-tube till its lower extremity is rather less than half an inch from the surface of the liquid in the bottle, and on letting fall a drop of cymole from it, beautiful spheroidal globules will be formed and roll about for some time, scarcely diminishing in size. This experiment may be performed with great advantage if the cymole be warmed first. An ordinary funnel with a filter may be substituted for the funnel-tube, and will answer well if the lower aperture of the funnel has a diameter of about ·13 of an inch. The experiment may be repeated with other materials with similar effects. That the spheroids are not in contact with the surfaces on which they roll, may be proved by saturating the liquid in the tube with something that shall have a visible effect upon a substance dissolved in the liquid in the bottle. A beautiful illustration of this occurs when, under conditions similar to those before mentioned, we employ in the funnel-tube a solution of sugar containing sulphocyanide of potassium, and in the bottle a solution of sugar, containing sesquichloride of iron; no red colouration takes place until the coalescence of the spheroids with the liquid beneath them. Many other chemical reactions may be made use of with similar results. It is very curious to see a solution of ferrocyanide of potassium floating upon a solution of sesquichloride of iron, while not a trace of Prussian blue is formed. These experiments must, of course, be recommenced whenever any union of the liquids employed has taken place. The cork spoken of above should have two perforations, one to admit the funnel tube, and the other to allow the escape of air.

Is the employment of a volatile substance essential to the production of these phenomena? I imagined that this question might be answered by the following experiment. A dish of platinum might be heated strongly, and a drop of melted lead then placed upon it; now if the production of vapour from the substances employed were essential to the formation of the spheroidal state, the lead should at once dissolve and perforate the platinum; if, however, the spheroidal state occurs when when two non-volatile substances are employed, the platinum vessel should not be perforated until its temperature has been considerably reduced. The experiment was tried with every precaution to prevent the oxidation of the lead and insure an accurate result; a perforation of the platinum ensued the moment of placing the melted lead upon it. This proves that the production of vapour is essential to the occurrence of the spheroidal state; for it cannot be urged that that condition is never manifested when metals only are employed; for a drop of a volatile metal, mercury (melted mercury, we may say, in order to render its relationship to melted lead the more apparent,) placed on an intensely heated surface of platinum instantly assumes the spheroidal form, and evaporating slowly, dances about in the vessel with peculiar movements. Upon thin, sonorous vessels of copper, &c., this movement takes place with such rapidity as to produce a musical tone of high pitch. I have sometimes seen globules of mercury and water rise to the height of six inches from the capsules in which they had been formed.

A word or two in conclusion, as an attempt at an explanation of the phenomena observed may not be out of place.

Since a space always exists between the lower body and that in the spheroidal state, and since that state is not manifested by non-volatile substances, it seems reasonable to conclude that the vapour proceeding from those parts of the liquids nearest to the containing vessel or subjacent fluid tends to assist the internal molecular cohesive force of the drops in assuming and maintaining their spheroidal form. Other forces originated by the temperature may also be in operation.

I should premise that the solution of sulphide of sodium employed in my first experiment made a dark stain upon silver even in the cold. This renders the nullity of its action at a high temperature the more remarkable. It will be scarcely necessary to mention, that, for the successful performance of most of these experiments, considerable manipulative care is required.—*Royal College of Chemistry, March* 18, 1854.

Bakerian Lecture—On Osmotic Force.

By Professor Graham.

This name was applied to the power by which liquids are impelled through moist membrane and other porous septa in experiments of endosmose and exosmose. It was shown that with a solution of salt on one side of the porous septum and pure water on the other side, (the condition of the osmometer of Dutrochet when filled with a saline solution and immersed in water,) the passage of the salt outward is entirely by diffusion, and that a thin membrane does not sensibly impede that molecular process. The movement is confined to the liquid salt particles, and does not influence the water holding them in solution, which is entirely passive: it requires no further explanation. The flow of water inwards, on the other hand, affects sensible masses of fluid, and is the only one of the movements which can be correctly described as a current It is osmose and the work of the osmotic force to be discussed. As diffusion is always a double movement,—while salt diffuses out, a certain quantity of water necessarily diffuses in at the same time, in exchange,—diffusibility might be imagined to be the osmotic force. But the water introduced into the osmometer in this way has always a definite relation to the quantity of salt which escapes, and can scarcely rise in any case above four or six times the weight of salt; while the water entering the osmometer often exceeds the salt leaving it at least one hundred times: diffusion therefore is quite insufficient to account for the water current. The theory which refers osmose to capillarity appears to have no better foundation. The great inequality of ascension assumed among aqueous fluids is found not to exist when their capillarity is correctly observed, and many of the saline solutions which give rise to the highest osmose are indistinguishable in ascension from pure water itself. Two series of experiments on osmose were described:—the first series made with the use of porous mineral septa, and the second series with animal membrane. The earthenware osmometer consisted of the porous cylinder employed in voltaic batteries, about five inches in depth, surmounted by an open glass tube 0·6 inch in diameter attached to the mouth of the cylinder by means of a cap of gutta percha. In conducting an experiment, the cylinder was filled with any saline solution to the base of the glass tube, and immediately placed in a large jar of distilled water: and as the fluid within the instrument rose in the tube during the experiment, water was added to the jar so as to prevent inequality of hydrostatic pressure. The rise (or fall) of liquid in the tube was highly uniform, as observed from hour to hour, and the experiment was generally terminated in five hours. From experiments made on solutions of every variety of soluble substances, it appeared that the rise or osmose is quite insignificant with neutral organic substances in general, such as sugar, alcohol, urea, tannin, &c.: so also with neutral salts of the earths and ordinary metals, and with chloride of sodium and potassium, nitrates of potash and soda, and chloride of mercury. A more sensible but still very moderate osmose is exhibited by hydrochloric, nitric, acetic, sulphurous, citric and tartaric acids. These

are surpassed by the stronger mineral acids, such as sulphuric and phosphoric acid, and sulphate of potash; which are again exceeded by salts of potash and soda, possessing either a decided acid or alkaline reaction, such as binoxalate of potash, phosphate of soda, and carbonates of potash and soda. The highly osmotic substances were also found to act with most advantage in small proportions, producing in general the largest osmose in the proportion of one-quarter per cent. of salt dissolved. Osmose is, indeed, eminently the phenomenon of weak solutions. The same substances are likewise always chemically active bodies, and possess affinities which enable them to act upon the material of the earthenware septum. Lime and alumina were accordingly always found in solution after osmose, and the corrosion of the septum appeared to be a necessary condition of the flow. Septa of other materials, such as pure carbonate of lime, gypsum, compressed charcoal, and tanned sole-leather, although not deficient in porosity, gave no osmose, apparently because they are not acted upon chemically by the saline solutions. Capillarity alone was manifestly insufficient to produce the liquid movement, while the *vis motrix* appeared to be chemical action. The electrical endosmose of Porrett, which has lately been defined with great clearness by Weidemann, was believed to indicate the possession of a peculiar chemical constitution by water, while liquid, or at least the capacity to assume that constitution when water is poralized and acting chemically upon other substances. A large but variable number of atoms of water are associated together to form a liquid molecule of water, of which an individual atom of oxygen stands apart, forming a negative or chlorous radical, while the whole remaining atoms together are constituted into a positive or basylous radical;—which last will contain an unbalanced equivalent of hydrogen giving the molecule basicity, as in the great proportion of organic radicals. Now, it is this voluminous basylous radical, which travels in the electrical decomposition of pure water, and resolves itself into hydrogen gas and water at the negative pole, causing the accumulation of water observed there; while the oxygen alone proceeds in the opposite direction to the positive pole. Attention was also called to the fact, that acids and alkalies, when in solution, are chemically combined with much water of hydration; sulphuric acid, for instance, evolving heat when the fiftieth equivalent of water is added to it. In the combination of such bodies, the disposal of the water is generally overlooked. Osmose was considered as depending upon such secondary results of combination; that is, upon the large number or voluminous proportions of the water molecules involved in such combinations. The porous septum is the means of bringing out and rendering visible, both in electrical and ordinary osmose, this liquid movement attending chemical combinations and decompositions. Although the nature and *modus operandi* of the chemical action producing osmose remains still very obscure, considerable light is thrown upon it in the application of septa of animal membrane. Ox bladder was found to acquire greatly increased activity, and also to act with much greater regularity, when first divested of its outer muscular coat. Cotton calico also, impregnated with liquid albumen, and afterwards exposed to heat, so as to coagulate that substance, was sufficiently impervious, and formed an excellent septum, resembling membrane in every respect. The osmometer was of the usual bulb-form, but the membrane was supported by a plate of perforated zinc, and the instrument provided with a tube of considerable diameter. The diameter of the tube being one-tenth of that of the mouth of the bulb or disc of membrane exposed to the fluids, a rise of liquid in the tube amounting to 100 millimètres indicated that as much water had permeated the membrane and entered the osmometer as would cover the whole surface of the membrane to a depth of one millimètre, or one twenty-fifth part of an inch. Such millimètre divisions of the tube become degrees of osmose, which are of the same value in all instruments. Osmose in membrane presented many points of similarity to that in earthenware. The membrane is constantly undergoing decomposition, and its osmotic action is inexhaustible. Further, salts and other substances capable of determining a large osmose are all chemically active substances, while the great mass of neutral monobasic salts of the metals, such as chloride of sodium, possess only a low degree of action, or are wholly inert. The active substances are also relatively most efficient in small proportions. When a solution of the proper kind is used, the osmose or passage of fluid proceeds with a velocity wholly unprecedented in such experiments. The rise of liquid in the tube with a solution containing one-tenth per cent. of carbonate of potash in the osmometer, was 167 degrees or millimetres, and with one per cent. of the same salt, 206 degrees in five hours. With another membrane and stronger solution the rise was 863 millimetres, or upwards of 30 inches, in the same time; and as much water therefore was impelled through the membrane as would cover its whole surface to a depth of 8·6 millimetres, or one third of an inch. The chemical action must be different on the substance of the membrane at its inner and outer surfaces to induce osmose; and according to the hypothetic view which accords best with the phenomenon, the action on the two sides is not unequal in degree only, but also different in kind. It appears as an alkaline action on the albuminous substance of the membrane, at the inner surface, and as an acid action on the albumen at the outer surface. The most general empirical conclusion that can be drawn is, that the water always accumulates on the alkaline or basic side of the membrane. Hence, with an alkaline salt, such as carbonate or phosphate of soda, in the osmometer and water outside, the flow is inwards; but with an acid in the osmometer, on the contrary, the flow is outwards, or there is negative osmose, the liquid then falling in the tube. In the last case, the water outside is basic when compared with the acid within, and the flow is therefore still towards the base. The chloride of sodium, chloride of barium, chloride of magnesium, and similar neutral salts, are wholly indifferent, or appear only to act in a subordinate manner to some other active acid or basic substance,—which last may be present in the solution or membrane in the most minute quantity. Salts which admit of dividing into a basic subsalt and free acid exhibit an osmotic activity of the highest order. Such are the acetate and various other salts of alumina, iron and chromium, the protochloride of iron, chloride of copper and tin, chloride of copper, nitrate of lead, &c. The acid travels outwards by diffusion, superinducing a basic condition of the inner surface of the membrane and an acid condition of the outer surface, the favourable condition of a high positive osmose. The bibasic salts of potash and soda again such as the sulphate and tartrate of potash, although strictly neutral in properties, begin to exhibit a positive osmose, in cousequence, it may be presumed, of their resolution into an acid supersalt and free alkaline base. The following table exhibits the osmose of substances of all classes:

Osmose of 1 *per cent. Solutions in Membrane.*

Oxalic Acid	—	148 degrees
Hydrochloric Acid	—	92
Terchloride of Gold	—	54
Bichloride of Tin	—	46
Bichloride of Platinum	—	30
Chloride of Magnesium	—	3
Chloride of Sodium	+	2
Chloride of Potassium		18
Nitrate of Soda		2
Nitrate of silver		34
Sulphate of Potash		21 to 60
Sulphate of Maguesia		14
Chloride of Calcium		20
Chloride of Barium		21
Chloride of Strontium		26
Chloride of Cobalt		26
Chloride of Manganese		34
Chloride of Zinc		54
Chloride of Nickel		88
Nitrate of Lead		125 to 211
Nitrate of Cadmium		137
Nitrate of Uranium		234 to 458
Nitrate of Copper		204
Chloride of Copper		351
Protochloride of Tin		289
Protochloride of Iron		435
Chloride of Mercury		121
Protonitrate of Mercury		356
Pernitrate of Mercury		476
Acetate of Sesquioxide of Iron		194
Acetate of Alumina		280 to 393
Chloride of Aluminum		540
Phosphate of Soda		311
Carbonate of Potash		439

It may appear to some, that the chemical character which has been assigned to osmose takes away from the physiological interest of the subject in so far as the decomposition of the membrane may appear to be incompatible with vital conditions, and that osmotic movements must therefore be confined to dead matter; but such apprehensions are, it is believed, groundless, or at all events premature. All parts of living structures are allowed to be in a state of incessant change of decomposition and renewal. The decomposition occurring in a living

membrane while effecting osmotic propulsion may possibly, therefore, be of a reparable kind.—In other respects chemical osmose appears to be an agency particularly adapted to take part in the animal economy. It is seen that osmose is peculiarly excited by dilute saline solutions, such as the animal juices really are, and that the alkaline or acid property which these juices always possess is another most favourable condition for their action on membrane. The natural excitation of osmose in the substance of the membranes or cell-walls dividing such solutions seems therefore almost inevitable. In osmose there is, further, a remarkably direct substitution of one of the great forces of nature by its equivalent in another force—the conversion, as it may be said, of chemical affinity into mechanical power. Now what is more wanted in the theory of animal functions than a mechanism for obtaining motive power from chemical decomposition as it occurs in the tissues? In minute microscopic cells the osmotic movements being entirely dependent upon extent of surface may attain the highest conceivable velocity. May it not be hoped therefore to find, in the osmotic injection of fluids, the deficient link which certainly intervenes between muscular movement and chemical decomposition?

Meteorology of the Second Quarter of 1854, at the Highfield House Observatory, Nottinghamshire, England.

Month.	Mean Elastic Force of Vapour or Mean Amount of Water mixed with the Air.	Mean Pressure of the Gases, or Dry Air.	Mean Pressure of the Gases and Water, or Mean Height of the Barometer.	Greatest Height of the Barometer.	Least Pressure of the Barometer.	Monthly range of Pressure.
	Inch.	Inches.	Inches.	Inches.	Inches.	Inches.
April	0·251	29·758	30·009	30·437	29·120	1·317
May	0·330	29·310	29·640	30·141	28·879	1·262
June	0·387	29·326	29·713	30·071	29·316	·0755
Mean	0·323	29·465	29·787	30·437	28·879	1·558

The elastic force of vapour in April was slightly less than the average; in May an eleventh of an inch above the amount of 1853 and ·021 inch above that of 1852; and in June ·029 inch above that of 1853, and nearly equal with that of 1852. The pressure of the atmosphere in April was a quarter of an inch greater than the average of the last seven years; in May 0·183 inch less, and in June 0·033 inch less than the average of the past seven years.

Month.	Adopted Mean Temperature.	Mean Temperature of the Wet Bulb Thermometer.	Mean Temperature of the Dew Point.	Mean Weight of Vapour in a Cubic Foot of Air.	Mean Additional Weight required to saturate a Cubic Foot of Air.	Mean Degree of Humidity.	Mean Whole Amount of Water in a Vertical Column of the Atmosphere.
	Degree.	Degree.	Degrees.	Grains.	Grains.	(1·000)	Inches.
April	46·4	43·6	38·5	1·89	1·00	0·742	3·47
May	50·0	49·1	46·7	3·82	0·67	0·851	5·66
June	55·3	53·3	51·1	4·39	0·87	0·834	5·35
Mean	50·3	48·7	45·4	3·33	0·85	0·809	4·83

The mean temperature in May and June has been exceedingly low. In April it was below that of 1853 by 0·4°, above that of 1852 by 0·1°, and below the mean of 42 years by 1°. May was 0·4° below that of 1853, 1·5° below that of 1852, and nearly 6° below the mean of the last 42 years. June was 3° below that of 1853, and 1·7° below June, 1852, and 3½° below the mean of the last 42 years. It is to be feared that this great cold will affect the yield of the wheat crop. The mean temperature of the dew point was in April ½° below, in May 1½° above, and in June 1½° below the mean of the past seven years. The mean weight of vapour in a cubic foot of air was, in April, 1·2 grains below, in May 0·2 grain above, and in June 0·4 grain below the average of the past six years. The whole amount of water in a vertical column of the atmosphere was about equal to the average in April and June, but 1·7 inches above the average in May.

Month.	Mean Weight of Cubic Foot of Air.	Maximum Heat in Shade.	Greatest Cold of Night.	Monthly Range of Temperature.	Mean Maximum Temperature.	Mean Minimum Temperature.	Diurnal Range of Temperature.
	Grains.	Degrees.	Degrees.	Degrees.	Degrees.	Degrees.	Degrees.
April	553·0	74·8	29·4	45·4	59·2	35·1	24·1
May	532·4	73·0	31·4	41·6	62·8	37·7	25·1
June	528·1	79·0	41·0	38·0	65·2	46·8	18·4
Mean	537·8	79·0	29·4	49·6	62·4	39·9	22·5

The mean weight of a cubic foot of air was in April 13 grains more than the average of the past six years. May, two grains less, and June two grains more than the mean. The greatest heat in shade was in April 5° more than in 1853, and 1° less than in 1852; in May 9° less than in 1853 and 6° less than in 1852; and in June 3° less than tn 1853 and 2° more than in 1852. The greatest cold of night in April and May was about the average, and in June 4° warmer than in 1853, and 1° warmer than in 1852. The mean of all the *maximum* readings of the thermometer in April was 2° above that of 1853, and slightly below that of 1852; in May about equal to the average temperature; and in June 6° below that of 1853, and about 4° below that of 1852. The mean of all the *minimum* readings of the thermometer in April was 3° below that of 1853, and slightly above that of 1852; in May 2° below that of 1853, and 5° below that of 1852; and in June 1½° below that of 1852 and 1853.

Month.	Greatest Cold on Grass.	Mean reading of a Minimum Thermometer on Grass.	Mean Maximum Heat of a Thermometer in the Sunshine.	Amount of Evaporation.	Amount of Rain. 2 feet above the ground	Amount of Rain. 25 feet above the ground.	Number of Days on which Rain fell.
	Degrees.	Degrees.	Degrees.	Inches.	Inches.	Inches.	
April	18·4	36·3	73·2	4·703	0·480	0·457	5
May	26·2	34·2	71·9	4·585	2·176	1·952	19
June	34·2	43·6	74·1	5·028	1·002	0·955	14
Mean	18·4	38·0	73·1	4·772	1·219	1·121	13

In April there were 15 nights' frost on the grass, and in May 14. The amount of evaporation for the quarter was 14·316 inches. The amount of evaporation in April was an inch above the average of the last six years, in May half an inch less, and in Jnne about equal to the average. The amonnt of rain in April was 1·2 inches less than the average of the last 10 years, in May 0·2 more, and in June 2·0 inches less than the average. April, 1844, was 0·1 inch drier than in 1854, and April 1850, equal to that of 1854; in 1846 the amount was 11 times that of April, 1854; in all other years the fall was from 0·8 inch to 3·8 inches more than in April, 1854.

Month.	General direction of wind.	Strength of the Wind.	Mean Amount of Cloud.	Mean Temperature of Evaporation.	No. of Days Thunder or Lightning occurred on.	Solar or Lunar Halos occurred on.	Hail or Snow fell on.
		(0—6)	(0—10)	Degrees.	Days.	Days.	Days.
April	E.N.E. & N.E.	0·3	4·9	42·9	3	3	1
May	S.W.	0·2	6·6	47·6	11	1	5
June	N.E. & S.	0·7	8·4	52·1	4	2	0
Mean	S.W. & NE.	0·4	6·6	47·5	6	2	2

A violent gale for this season of the year occurred on the 26th of June from the S., and afterwards from the S.W. The average amount of cloud for April (from seven years' observations) is 6·7, for May 6·0, and for June 6·6. This year, April was very free from clouds, one-fifth of the sky being less cloudy than usual. May was in a slight degree more overcast than the average, and June was much more overcast, one-fifth part of the sky being more overcast than the average of that month. The Chiff-chaff arrived on the 1st of April, four days earlier than usual; Ribes sanguineum came into bloom on the 1st of April, one day earlier than usual: the Swallow arrived on the 14th o April, its average time; Daphne cneorum was in bloom on the 16th of April, 11 days earlier than usual; the Landrail arrived on the 2nd of May, 17 days earlier than usual; the Cuckoo on the 8th of May, 11

days later than usual; the Lilac was in bloom on the 5th of May, 11 days earlier than usual; and Strawberries were ripe on the 14th of June, one day earlier than usual.—*London Times.*

E. J. LOWE.

On the Electro-Plating of Metallic Articles with White Metals, Aluminium and Silicium, from Clay, Stone, and Sand.

By G. Gore, M.D.

It has long been known to chemists that all kinds of clay, stone, and sand, of which the crust of the earth is composed, consist of metals combined with oxygen, carbonic acid, sulphuric acid, and other non-metallic elements, forming therewith oxides, carbonates, sulphates, &c.; thus clay is an oxide of aluminium, sand an oxide of silicium, limestone a carbonate of the oxide of calcium. But the separation of the metallic bases from the non-metallic elements with which they are combined, has been a matter of so great a difficulty, that but few chemists have put themselves to the trouble of accomplishing it, and those who have done so have made use of the most powerful means and reducing agents, such as large voltaic batteries, potassium, &c., and have then obtained them in a state of alloy or combination with mercury. Sir Humphrey Davy, the discoverer of most of these bases, in his experiments on the decomposition of the alkalies and earths, used a powerful battery, consisting of 500 pairs of plates, and then succeeded in obtaining them combined with mercury, from which they were afterwards separated; Wohler and Berzelius, in their discoveries of the means of separating the metals aluminium and silicium from their respective compounds, clay and sand, used a high temperature and potassium, and then, succeeded in obtaining them in the condition of dull metallic powders, nearly invisible.

By a means recently discovered, and described in the March number of the "Philosophical Magazine" for this year, I have succeeded in depositing the metals aluminium from clay, and silicium from sand stone, each in a perfect metallic condition, by dissolving pipe-clay, common red sand, pounded stone, &c., in various chemical liquids, and passing currents of electricity from ordinary small voltaic batteries through the solutions.

My attention has since been directed to produce simple processes, whereby any person not possessing a knowledge of chemistry may readily coat articles with those metals, and cause the discovery to be immediately applied to human benefit in the arts and manufactures, and the following are the results of my experiments :—

To coat articles of copper, brass, or German silver, with aluminium, take equal measures of sulphuric acid and water, or take one measure each of sulphuric and hydrochloric acids and two measures of water; add to the water a small quantity of pipe-clay, in the proportion of five or ten grains by weight to every ounce by measure of water (or $\frac{1}{2}$ oz. to the pint), rub the clay with the water until the two are perfectly mixed, then add the acid to the clay solution, and boil the mixture in a covered glass vessel one hour. Allow the liquid to settle, take the clear, supernatant solution, while hot, and immerse in it an earthern porous cell, containing a mixture of one measure of sulphuric acid and ten measures of water, together with a rod or plate of amalgamated zinc; take a small Smee's battery, of three or four pairs of plates, connected together intensity fashion, and connect its positive pole by a wire, with the piece of zinc in the porous cell. Having perfectly cleaned the surface of the article to be coated, connect it by a wire with the negative pole of the battery, and immerse it in the hot clay solution; immediately abundance of gas will be evolved from the whole of the immersed surface of the article, and in a few minutes, if the size of the article is adapted to the quantity of the current of electricity passing through it, a fine white deposit of aluminium will appear all over its surface. It may then be taken out, washed quickly in clean water, and wiped dry and polished; but, if a thicker coating is required, it must be taken out when the deposit becomes dull in appearance, washed, dried, polished, and re-immersed; and this must be repeated at intervals, as often as it becomes dull, until the required thickness is obtained. With small articles it is not absolutely necessary, either in this or the following process, that a separate battery be employed, as the article to be coated may be connected by a wire with the piece of zinc in the porous cell, and immersed in the outer liquid, when it will receive a deposit, but more slowly than when a battery is employed.

To coat articles with Silicium. Take the following proportions: three-quarters of an ounce, by measure, of hydrofluoric acid, a quarter of an ounce of hydrochloric acid, and forty or fifty grains either precipitated silica or of fine white sand, (the former dissolves most freely), and boil the whole together a few minutes, until no more silica is disolved. Use the solution, exactly in the same manner as the clay solution, and a fine white deposit of metallic silicium will be obtained, provided the size of the article is adapted to the quantity of the electric current; common red sand, or indeed any kind of silicious stone, finely powdered may be used in place of the white sand, and with equal succees, if it be previously boiled in hydrochloric acid, to remove the red oxide of iron or other impurities.

Both in depositing aluminium and silicium, it is necessary to well saturate the acids with the solid ingredients by boiling, otherwise very little deposit of metal will be obtained.

Among the many experiments I have made upon this subject, the following are a few of the most interesting :—Experiment 1. Boiled some pipe-clay in caustic potash and water, poured the clear part of the solution into a glass vessel and immersed in it a small earthen porous cell, containing dilute sulphuric acid and a piece of amalgamated zinc; immersed a similar piece of bright sheet copper in the alkaline liquid, and connected it with the negative pole of a small Smee's battery of three pairs of plates connected the zinc plate with the positive pole, and let the whole stand undisturbed all night: on examining it next morning I found the piece of copper coated with a white silver-like deposit of metallic aluminium.

Experiment 2. Obtained from a railway cutting in the town, a small piece of the sand rock upon which Birmingham is built, boiled it in hydrochloric acid, to remove the red oxide of iron, washed it clean with water, and dissolved it by boiling in a mixture of hydro-fluoric acid, nitric acid, and water; immersed in this solution, a porous cell with dilute acid and zinc as before; connected a piece of brass with the zinc by a wire, and suspended it in the outer liquid, which was kept hot by means of a small spirit lamp beneath; after allowing the action to proceed several hours, I found the piece of brass beautifully coated with white metallic silicium.

Experiment 3. Took one part, by weight, of the same sand stone, after being purified by the hydrochloric acid, and $2\frac{1}{4}$ parts of carbonate of potash, fused them together in a crucible until all evolution of gas ceased, and a perfect glass was formed: poured out the melted glass, and when cold dissolved it in water and used this solutiom in the same manner as the former ones, allowing the action to proceed about twelve hours, when a good white deposit of metallic silicium was obtained.

Experiment 4. Took some stones with which the streets of Birmingham are macadamised, pounded them fine in a mortar, boiled the powder in hydrochloric acid, to purify it from iron, washed it well in water, and dissolved it by boiling an excess of it in a mixture of $\frac{3}{4}$ oz., by measure, of hydro-fluoric acid, $\frac{1}{2}$ oz., of water, and $\frac{1}{8}$ oz. each of nitric and hydro-chloric acids, until no more would dissolve; used the clear portion of this solution in the same manner as the former liquids, and readily coated in it a piece of brass with a beautifully white deposit either of aluminium or silicium.

From these and many other experiments which I have tried, it is quite clear that common metal articles may be readily coated with white metals, possessing similar characters to silver, from solutions of the most common and abundant materials, and thus bring within the purchase of the poorer classes articles of taste and cleanliness which are at present only to be obtained by the comparatively wealthy.

The following specimens accompany the communication, and may be seen at the society's house ;—

1st. One specimen each of sheet copper and brass, coated with aluminium from "Pipe-clay," according to process described.

2nd. One specimen each of sheet copper and brass, coated with silicium, from silica and sand, according to process described.

3rd. Specimen of Birmingham sand rock.

4th. Specimen of ditto, purified by hydro-chloric acid.

5th. Specimen of sheet metal coated with silicium from Birmingham sand-stone.

6th. Specimen of road stone with which Birmingham streets are macadamized.

7th. Ditto in a state of powder.

8th. Ditto, purified by hydrochloric acid.

9th. Specimen of sheet brass coated with silicium from this road stone.

BIRMINGHAM, 24th MARCH, 1854.

Gold—Its Distribution.*

Notwithstanding the preceding sketch, it would ill become any geologist who throws his eye over the gold map of the world prepared by Adolf Erman, to attempt to estimate, at this day, the amount of gold which remains, like that of Australia, undetected in the vast regions of the earth, as yet unknown even to geographers; still less to speculate upon the relative proportions of it in such countries. At the same time, the board features of the case in all known lands may be appealed to, to check extravagant fears and apprehensions respecting an excessive production of the ore. For we can trace the boundaries, rude as they may be, of a metal ever destined to remain precious on account of those limits in position, breadth, and depth by which it is circumscribed in Nature's bank. Let it be borne in mind that, whilst gold has scarcely ever been found, and never in any quantity, in the secondary and tertiary rocks which occupy so large a portion of the surface, mines sunk down into the solid rocks where it does occur have hitherto, with rare exceptions, proved remunerative; and when they are so it is only in those cases where the rocks are soft, or the price of labour low. Further, it has been well ascertained, whatever may have been the agency by which this impregnation was effected, that the metal has been chiefly accumulated towards the surface of the rocks; and then, by the abrasion and dispersion of their *superficial* parts, the richest golden materials have been spread out, in limited patches, and generally near the bottom of basin-shaped accumulations of detritus. Now, as every heap of these broken auriferous materials in foreign lands has as well defined a base as each gravel-pit of our own country, it is quite certain that hollows so occupied, whether in California or Australia, must be dug out and exhausted in a greater or less period. In fact, all similar deposits in the Old or New World have had their gold abstracted from heaps whose areas have been traced and whose bottoms were reached. Not proceeding beyond the evidences registered in the stone-book of Nature, it may therefore be affirmed, that the period of such exhaustion in each country (for the deposits are much shallower in some tracts than in others) will, in great measure, depend on the amount of population and the activity of the workmen in each locality. Anglo-Saxon energy, for example, as applied in California and Australia, may in a few years accomplish results which could only have been attained in centuries by a scanty and lazy indigenous population; and thus *the present large flow of gold into Europe from such tracts, will, in my opinion, begin to diminish within a comparatively short period.* * * In conclusion, let me express my opinion, that the fear that gold may be greatly depreciated, in valuo relatively to silver—a fear which may have seized upon the minds of some of my readers—is unwarranted by the data registered in the crust of the earth. Gold is, after all, by far the most restricted—in its native distribution—of the precious metals. Silver and argentiferous lead, on the contrary, expand so largely downwards into the bowels of the rocks, as to lead us to believe that they must yield enormous profits to the skilful miner for ages to come; and the more so in proportion as better machinery and new inventions shall lesson the difficulty of subterranean mining. It may, indeed, well be doubted whether the quantities of gold and silver, procurable from regions unknown to our progenitors, will prove more then sufficient to meet the exigencies of an enormously increased population and our augmenting commerce and luxury. But this is not a theme for a geologist; and I would simply say, that Providence seems to have originally adjusted the relative value of these two precious metals, and that their relations, having remained the same for ages, will long survive all theories. Modern science, instead of contradicting only confirms the truth of the aphorism of the patriarch Job, which thus shadowed forth the downward persistence of the one and the superficial distribution of the other:—'Surely there is *a vein* for the silver......The earth hath *dust of gold.*,' "

* *Siluria: or the History of the Oldest Known Rocks containing Organic Remains.* By Sir Roderick Impey Murchison.

The Society of Arts.

The Society of Arts was established at a meeting held on the 22d March, 1754, at which it received the designation which it still retains —"The Society for the Encouragement of Arts, Manufactures, and Commerce in Great Britain." The first stone of the present building was laid on the 28th March, 1772; the two brothers, ROBERT and JOHN ADAM, from whom the *Adelphi* derives its name, were its architects, and the Society first occupied it in 1774. Within the period which has since passed, many valuable inventions which now minister to our wants and our enjoyments, trace their origin to that association.—Many distinguished men owe to the opportunities it presented their eminence in public life; and favourable audiences have constantly, during the discussions of the Society blushed at the hesitating timidity of GOLDSMITH, and admired the profound and massive wisdom of JOHNSON. Its objects, like its means, were at first limited, but the six celebrated pictures in the Council Room, painted by BARRY between the years 1777 and 1783, while highly illustrative of the state of the arts at that day, enable us in some degree to contrast the advance which civilization and science have since made in manufactures and commerce. With the Society of Arts originated the conception of the Great Exhibition of 1851; and in the Crystal Palace at Sydenham, on Monday the 3d July, it celebrated its centenary by a public dinner, at which nearly 800 persons were present, and over which Earl GRANVILLE, in the absence of the Duke of NEWCASTLE, presided. The temple which then surrounded that assembly, dedicated to all the triumphs of ancient and modern art, would not now excite our admiration, exalt our race, and illustrate our age, were it not for the prudent and philosophic efforts of the humble but long unconscious founders of the early institution. A century hence will find those who joined in that celebration all equally silent; and it is beyond the speculative powers of the most reflective mind to anticipate what fresh triumphs genius, science, and art may unfold, to grace and adorn the revival of such an anniversary.

Electro-magnetic Engraving Machine.

This machine is somewhat on the principle of the well-known planing machine. The drawing to be copied and the plate to be engraved are placed side by side, on the moveable table or lid of the machine; a pointer or feeler is so connected, by means of a horizontal bar, with a graver, that when the bar is moved, the drawing to be copied passes under the feeler, and the plate to be engraved passes in a corresponding manner under the graver. It is obvious that in this condition of things, a continuous line would be cut on the plate, and, a lateral motion being given to the bed, a series of such lines would be cut parallel to and touching each other, the feeler of course passing in a corresponding manner over the drawing. If, then, a means could be devised for causing the graver to act only when the point of the feeler passed over a portion of the drawing, it is clear we should get a plate engraved, line for line, with the object to be copied. This is accomplished by placing the graver under the control of two electro-magnets, acting alternately, the one to draw the graver from the plate, the other to press it down on it. The coil enveloping one of these magnets is in connexion with the feeler, which is made of metal. The drawing is made on a metallic or conducting surface, with a rosined ink or some other non-conducting substance. An electric current is then established so that when the feeler rests on the metallic surface, it passes through the coils of the magnet, and causes it to lift the graver from the plate to be engraved. As soon as the feeler reaches the drawing, and passes over the non-conducting ink, the current of electricity is broken, and the magnet ceases to act, and by a self-acting mechanical arrangement the current is at the same time diverted through the coils of the second magnet, which then acts powerfully and presses the graver down. This operation being repeated until the feeler has passed in parallel lines over the whole of the drawing, a plate is obtained engraved to a uniform depth, with a fac-simile of the drawing. From this a type-metal cast is taken, which, being a reverse in all respects of the engraved plate, is at once fitted for use as a block for surface printing. The machine is the invention of Mr. William Hansen, of Gotha.—*Journal of the Society of Arts.*

On the Colouring of Wool by Murexide.

Prout discovered the peculiar substance described by him under the name of purpurate of ammonia, which was afterwards very fully examined by Liebig and Wöhler and received from them the name of murexide, from murex, a shell-fish, from which the celebrated Syrian purple was supposed to have been obtained. This most curious substance exhibits in an extraordinary degree, the property of dichroism, being of a splendid garnet red by transmitted, and of a beautiful iridescent green by reflected light; its preparation, however, is somewhat complicated, being produced according to Gregory's process, by the action of carbonate of ammonia on a mixture of alloxan and alloxantine, two bodies resulting from the action of nitric acid, &c., upon uric acid.

No method of fixing this beautiful colour on textile fabrics has been discovered, until lately the subject having engaged the attention of M. M. Sacc and Schlumberger, a process has been invented by which cloth can be dyed of a colour far surpassing that produced by cochineal.

It was well known that the skin when moistened with a solution of alloxan and exposed to the air, became purple, and M. Schlumberger soaks the cloth in a solution of that substance, squeezes out the excess of liquid by pressure between rollers, dries at a gentle temperature, and after ageing for twenty-four hours, brings out the colour completely by passing the cloth over a roller heated to 212° Fahr.

The colour appears as if by magic, and is said to be far superior to that produced by any preparation of cochineal, or by red dye-woods.—The cloth previous to being put into the dye-beck must be mordanted with weak tin salts, as unmordanted cloth does not give so satisfactory a result. It has also been found by M. Dollfuss that the process of ageing may be replaced by simple exposure to the vapors of ammonia.

The colour cannot be applied to cotton and silk, but only to wool; it resists sun-light very strongly, but it is partially destroyed by boiling water, especially if the cloth had been mordanted previous to the application of the alloxan. It is also destroyed by alkalies; and, hence, after a time by soap. Various shades can be produced by using solutions of different degrees of strength.

The price of the dye-stuff would exceed that of cochineal, but would be much lowered if uric acid became an article of commerce, as this substance can be readily obtained from pigeon's dung, guano, and the excrement of all carnivorous birds.

M. Schlumberger has indulged in some curious speculations relative to the existence of this colouring matter ready formed in nature. M. Sacc has found that poultry, and especially birds with a very brilliant plumage such as the parroquets, do not produce sensible traces of the uric acid during the moulting period, whilst the quantity is very large when their feathers are fully developed. The question naturally arises, What beomes of the uric acid? May it not be transformed by some as yet unknown metamorphosis in the animal body, into a substance like alloxan, capable of colouring the feathers? From the dichroism of murexide, above noticed, it is evident that this substance is capable of producing all shades of colours which are made up of red, blue and yellow. Hence, it is probable, that murexide is the cause of the brilliant plumage in birds. Further, it is chiefly those animals which have but one exit for their excrements, and who produce large quantities of uric acid, that exhibit a display of colours. Thus we have the skin of the serpent and lizard, the wings of butterflies, the scales of fish, often coloured in the most gorgeous manner; whilst the skins of mammalia are generally dull, and without that metallic lustre and iridescence so peculiar to the animals above mentioned. These however are mere speculations.

The ancients were acquainted with a process for dyeing wool of a fine purple, which has been lost to our days; but, tradition tells us, that this beautiful tint was produced by pounding a quantity of small shell-fish, and adding to the mass, either a quantity of urine in a state of putrefaction or water in which some of the same shell-fish had been allowed to putrefy. The cloth soaked in the liquid thus produced, only developed the beautiful purple colour after long exposure to the air, and probably to heat. It seems probable that the Tyrian purple was produced by murexide.

Manufacture of Paraffine from Bituminous Shale.

Immense quantities of black bituminous Shale exist in Upper Canada. The Utica Slate and the Hamilton group are especially rich in Bitumen. The distribution of these rocks in Upper Canada will be seen by an inspection of the Geological Map which accompanies Mr. Logan's admirable paper. We have before had occasion to refer to the attention with which the bituminous Shales of Canada have been distinguished. It will be some relief to those who have speculated vainly upon their value as a combustible material to find that they may be employed for the production of Paraffine.

"The process of distilling bituminous Shale, first effected on a large scale by Selligue, in France, is now carried on with great success by Wiesmaun & Co., at Beuel, near Bonn, on the Rhine. The paraffine is employed in the manufacture of candles, and has been found to *compete advantageously with wax and spermaceti*, at 66⅔ dollars (£10 5s. 4d.) the 100 lbs., or something more than 2s. per lb. The lightest volatile oil obtained has a specific gravity of 0·730, and like the benzin of coal tar, is well adapted for cleaning clothes, gloves, &c., as a solvent for various resins, &c. It is also mixed with the denser oils, and produces a mixture of a specific gravity of 0·830, which is used as camphine in lamps. It is of a light straw colour, and is sold in zinc jars, at the rate of 30 dollars (£4 12s. 6d.) per 100 quarts. or somewhat less than 1s. per quart. The fixed oils are rendered drying, and are employed for painting external wood-work, &c. It is also occasionally burned for the production of fine lamp-black for the manufacture ef lithographic and letter-press printing ink. A quantity of asphalte is also obtained, which is used for various purposes; and a greasy stuff, which is used for lubricating the axles, &c., of corves and other waggons in mines, &c. The success of this manufacture is very encouraging for the promoters of the similar one from turf, now completed near Athy.—*Polytechnisches Centralblatt.*

The Ontario, Simcoe, and Huron Railroad.

The Report submitted by the Board of Directors to the Proprietors, at their annual meeting, July 17th, 1854, furnishes a very satisfactory and encouraging account of the present operation of this important line and its future prospects. This Report having already appeared, *in extenso*, in various public journals, we shall confine ourselves to a brief abstract of its contents:—

The entire length of this line, from Toronto to Collingwood Harbor, Lake Huron, is 94½ miles; 64½ miles are now in permanent operation, and served by the following way stations—

Way Stations.	Miles from Toronto.	Way Stations.	Miles from Toronto.
1. Davenport Road......	5·1	9. Holland Landing...	38·1
2. Weston	8·0	10. Bradford	41·7
3. York	11·8	11. Scanlans..............	44·6
4. Thornhill	14·5	12. Lefroy.................	52·0
5. Richmond Hill........	18·5	13. Bell Ewart (branch)	53·5
6. King	22·8	14. Pratts	59·5
7. Aurora..................	30·1	15. Barrie	63·2
8. Newmarket...........	34·4		

The Company's steamer *Morning* makes the daily circuit of Lake Simcoe, and thus establishes a regular connection between Toronto and the country bordering a shore of nearly 150 miles.

The northern division of the line, from Barrie to Collingwood, 31½ miles in length, will be completed early in September. The selection of Collingwood Harbour by the Chief Engineer has proved very judicious, and the necessary works for the safety of shipping are in rapid progress.

Lighthouses are already being constructed by the Government for

the safe navigation of Georgian Bay and its channels to Lake Huron. The uncertainty in which the City Esplanade works appear to be involved, will not permit of permanent wharfage and depots to be constructed at Toronto until all donbt as to the intentions of other railway companies is removed. The entire cost of the road, up to the 1st July, amounts to £702,286. 1s. 3d., including construction of line, locomotive and general rolling stock, way stations, terminal depot, harbour and steamboat services. With reference to the through route, the Chief Engineer, Mr. Cumberland, records the following encouraging opinion of the prospects of the Northern Road:—

"It has always been urged that the trade of the north-western territory of the United States, as well as of that of the mineral regions of Lake Superior, would find a cheaper, more facile, and rapid outlet to the Atlantic, by your Road, than by any other possible line of transit, Nothing has yet occurred, or is likely to present itself, to weaken this position."

The Superintendent's Report is a voluminous and talented exposition of the working cost, expenditure, returns, and, more particularly, the prospects of the line. The traffic exceeds the most sanguine expectations which had been formed of it. Without any through travel the receipts have gradually increased until they now equal the earnings per mile of the Montreal and Portland section of the Grand Trunk Railway. From a local traffic alone the road is earning £15 currency per mile per week, and Mr. Brunel estimates that, by a judicious management, a through traffic may be obtained which will yield a gross revenuo of £80,000, making, with the local traffic, £135,000 per annum, of which 50 per cent. will be required for current expenses, leaving £68,000 for net revenue, or 8 per cent. on the entire cost of the Road: which, after paying 6 per cent. interest on the debt, leaves a dividend of 14 per cent on the stock issued.

With respect to the future prospects of the Road, we subjoin the following extracts from the Superintendent's Report—

"Notwithstanding the severe competition which exists between the various parallel lines of railroads terminating at the Atlantic cities of the United States, it is shown by statistics of the clearest and most satisfactory nature, given by W. J. McAlpine, Esq., in his Report on the Canals of the State of New York, for 1853, that, in the conveyance of freight, railways cannot compete with water carriage on the limited scalo afforded by the Erie Canal; how much less, then, can they compete with our magnificent lake navigation! and herein lies the strength of your route as compared with all others, for by connecting the navigation of the lakes, by spanning the isthmus of Canada, at the narrowest point, your road shortens the aggregate distance between Lake Michigan and the Atlantic cities some 300 miles, avoids the tedious navigation of the St. Clair Flats, over which large vessels are usually lighted, and saves the tolls, expenses, and delays incident to the Welland Canal, by the introduction of but 93 miles of railway."

"Nor is your road less favourably situated as regards a passenger business. Your northern terminus on Lake Huron will, on completion of your lino, be reached in 22 hours from New York, and in 28 hours from Boston. From your terminus the traveller can be conveyed to Milwaukie in 34 hours, through a navigation of which 200 miles is as safely sheltered as the Hudson or St. Lawrence rivers, and through which the scenery is infinitely superior to either; thus Milwaukie can be reached in 56 hours, by a route so agreeably diversified by changes from steamboat to railroad as to afford every desirable rest and refreshment."

"Comparing this with the shortest possible route between the same points, we find that the same journey can be performed by a continuous line of express railway travel, on which no rest or change is afforded, except from one set of cars to another, and by crossing the bridge and ferry at the Niagara and Detroit frontiers, in 46 hours, thus saving, at the expenso of all comfort, rest, and convenience, 10 hours; for which, however, the traveller must pay not less than six dollars in money, and at least one day to recruit himself for business. Nor will the traveller for Chicago fail to discover the greater convenience of your road, for, by the loss of only 16 hours in a journey of one thousand miles, which will be spent in the enjoyment of necessary repose, he can reach his destination fresh and ready for business at a less expense than by the shortest railway route, and, if necessary, ready to proceed at once on his further journey into the interior, over any of the numerous railways diverging from Chicago."

The following statistics of the line are interesting. They are contained in the Appendix to the Report—

Number of passengers of all classes carried in cars:—

Adults	106,391
Children	3,542
Free, and carried for construction	8,038

Number of miles travelled by passengers of all classes, or number of passengers carried one mile:—

Adults	2,875,742
Children	94,749
Free, and carried for construction	215,016
	3,184,489

It is worthy of note that the traffic on this line has been in the ratio of upwards of three million passengers carried one mile in twelve months, *without* the occurrence of an accident—a circumstance without a parallel, we believe, on this continent, and one which reflects the greatest credit on the superintendence of Mr. Brunel.

NUMBER OF TONS OF FREIGHT OF 2000lbs. CARRIED.

Moving.	1st Class.	2d Class.	3d Class.	Wheat.	Flour.	Car Loads, Various.	Total.
North.......	1191	2462¼	3320¾	8	......	790	7772
South.......	264½	891	937¼	6338	7518¾	13320	29360

Total number of Tons....................37,132
Total movement of freight or number of tons carried 1 mile. 1,239,763½

	Miles.
Average rate of speed adopted by ordinary Passenger Train (including stops) per hour	20
Rate of speed when in motion	25
Averago rate of speed of Express Trains (including stops) per hour	25
Rate of speed when in motion	30
Average rate of speed of Freight Trains (including stops) per hour	12
Rate of speed when in motion	17
Average weight in Tons of Passenger Trains, exclusive of Engine, Passengers, and Baggage	53
Average weight in Tons of Freight Trains, exclusive of Engine and average Freight, tons (2000 lbs.)	60

Canada Grand Trunk Railway.

Wo have not space to notice at length the Report of the Directors and Engineer of the Grand Trunk Railroad, just published. We shall, however, give copious extracts in the next issue of this Journal. Meanwhile, we quote the opinion of the *American Railroad Journal* on that portion of this stupendous work which is in activo operation:—

"Tho road is unquestionably one of the best constructed works of this kind in the country. Though traversing for nearly 100 miles the most mountainous portion of the Eastern States, it has an admirable line, with no grades imposing a serions impediment to a heavy traffic. There is no road in the United States where, to a stranger, there are so many apparent obstacles, but which disappear one after another as they are approached. Just the appropriate kind of solution appears to havo been resorted to in each emergency, and a person riding over

the road experiences a satisfaction similar to what he feels at the contemplation of any perfect specimen of *art*. The road is certainly one of our best specimens of engineering skill, and one in which *science* has contributed most in guiding and assisting *labour*. The work may be regarded as a *chef d'œuvre*."

The earnings on 292 miles of road in operation, for the week ending July 22nd, 1854, were from the following sources:—

No. 4,579	Passengers, first class	$5,332 95
No. 323½	Passengers, second class	235 90
No. 2,418¼	Tons Merchandise	5,865 84
No. 557,627	Feet of Lumber	2,027 12
No. 943	Cords of Fire Wood	1,318 90
Mails, &c.		779 27
Total earnings for the week		$15,559 98
Previous earnings since January 1, 1854		390,368 77
Total earnings since January 1st		$405,928 75

Canada Great Western Railway.

The earnings for the week ending August 4th, 1854, on 229 miles of road in operation, were from the following sources:—

From Passengers	£2,429	0	7
From Freight	589	8	6
From Sundries	268	10	4
Total earnings	£3,286	19	5
Amount of previous receipts	144,456	14	2½
Total receipts since the 1st of January	£147,743	13	7½
Total number of Passengers since 1st January	202,565½		

Nova Scotia Railways.

The *State of Maine* informs us that Nova Scotia and New Brunswick have both adopted the gauge of 5½ feet making it uniform with the line of the Graud Trunk Railway of Canada; and when the various sections, the "*disjecta membra*," in Canada, Maine, and in the provinces east, become connected, they will form an unbroken line of railway, of uniform gauge, from Halifax to Detroit.

In 1853 Nova Scotia provisionally agreed to adopt the "Company principle," similar to that of New Brunswick, and six months time was allowed after the royal assent, for the organization of the Company.—On the failure of this, "the government scheme" was to come into operation.

The war in Europe checked, and in fact defeated the plans of those who sought to inaugurate the Company within the six months, and at the end of that time Mr. Howe introduced and carried through Parliament his scheme for a government line.

The work was commenced on the 8th of June, 1854, at Halifax, and a section of some ten miles is under contract to be opened this year.—An additional section of fifteen miles will be opened in 1855.

The first 25 miles forms a common Trunk for the lines running to Amherst, to Windsor and to Pictou, and we learn from Mr. Howe that they intend to push the Trunk line to the frontier of New Brunswick, so as to meet their line at that point, as soon as it can reach it, from St. John. They will then extend branch lines to Windsor and Pictou as occasion may require.

The Province of Nova Scotia has an overflowing Treasury, and is free of debt. For some years to come, the city of Halifax will furnish a ready market for her debentures, at 5 per cent, and as the line proposed will form an important link in the Great Trunk Railway from Halifax to the United States and Canada, no fears are entertained as to the paying qualities of the Line."

Railways in New Brunswick.

We learu (says the same authority) from A. C. Morton, Esq. Chief Engineer of the European and North American Railway, in New Brunswick, who is now in this city, that the contractors for building the East and North American Railway in that Province, Messrs. Jackson, Brassey, Peto and Betts, are pushing on, with all practicable despatch, the construction of the entire line from St. John to the Gulf of St. Lawrence, and to the frontier of Nova Scotia. A large portion of the rails are already delivered, and the iron bridges are either all received, or already shipped from England. All the principal bridges are of iron, similar to those going up on the Quebec and Richmond Railway, and the road is to be of a superior character throughout.

Some difficulty exists, from the scarcity of labourers, but from the present posture of the work it is believed that during the coming year the line may be completed from St. John to the Nova Scotia line. The locating surveys are finished, and the work is sub-let to American contractors.

Niagara Suspension Bridge—The new Suspension Bridge over the Niagara River, connecting the Great Western and New York Central Railways, will possess a strength equal to six times the tension that can be produced by a maximum strain on the upper floor and a full load on the lower floor at the same time. —The permanent tension of the cables from their own weight and that of the superstructure, will be only one-tenth of their ultimate strength. There is, therefore, ample provision for safety. Moreover, the whole structure will be so arranged and stayed, that no oscillations or very perceptible movement can take place. A hurricane which would prostrate the whole city of Buffalo, and every wooden bridge in the country would be harmless to this bridge—so well will it be guarded by stays.

Angle Railroad Wheels.— One of the most interesting sights in Paris, and one that no American ever thinks of visiting, as he probably never heard of it, is the railroad from the Barrier d' Enfer to Sceaux. It is but seven miles long, and was built as an experiment upon a new system of wheels. The engine, tender, and hindermost car of the train, are furnished with oblique wheels, under the ordinary upright ones. Where the track is straight, these do not touch the rails; but at the curves, they come into play, rattling along the inner edge of the rails, and preventing the train from running off the track, The road was therefore made purposely tortuous, and the most sudden and seemingly dangerous bends were introduced at frequent intervals. The two stations are circular, and the train as it receives its passengers, is doubled up into a ring of 50 feet radius. The smallest curve upon the road is 68 feet radius, and over this the train goes at full speed. The corners of the cars are cut off, so that the vehicles, in following the curves, do not infringe upon each other. Sceaux is upon an eminence, which the road ascends spirally, with something like a mile of tract—it only going, in advance, a hundred feet. The invention—which, by the way, is ten years old—has proved practically very successful; but it has never been applied to any extent. *Daily Times N Y.*

Paper from Wood.—In the last sitting of the Societe d'Encouragement pour I'Iudustrie Nationale a paper was read setting forth a plan for making paper from wood. The bark is first taken off the wood, and the wood is then cut in such a way as to be easily made into shavings; the shavings are then cut very thin; next they are placed in water for six or eight days, then they are dried, afterwards they are reduced to the finest powder possible by the means of a corn mill. This powder is then mixed with the rags which serve to prepare the pulp of paper, and the ordinary operation of paper making is proceeded to. All white woods, such as the poplar, the lime, and the willow, are suitable for the purpose, but the discoverer ascribes a good deal of his success to the quality of water he employed—that of the little river Dollar, which runs near Mulhouse. For the first experiment he employed the wood of the trembling poplar, and he presented specimens of paper made from it.

Canadian Institute.

EXTRACTS FROM THE MINUTES OF COUNCIL, JUNE 3RD, 1854.

G. W. Allan, Esq., Secretary of the Canadian Institute, offered a piece of ground on George Street, 50 feet frontage by 130 in depth, as a site for a building for the purposes of the Institute.

Mr. Allan's liberal offer was cordially accepted by the Council, and the thanks of the Institute were ordered to be given to that gentleman.

A donation from the Rev. G. Bell, of Simcoe, was announced. Mr. Bell's donation consisted of a large number of Indian Remains and Geological Specimens.

The thanks of the Institnte were ordered to be transmitted to the Rev. Mr. Bell, for his valuable donations.

The following gentlemen were proposed Members of the Institute:—

Mr. Small, ... Collingwood Harbour.
Rev. Professor J. Smith, ... Kingston.
Rev. Professor J. Williamson,... Kingston.
Mr. H. N. Courtlandt .... Simcoe.

COUNCIL MEETING, JULY 21ST, 1854.

The following donations wero announced by the Vice President.—

"The Bombay Magnetical and Meteorological Observations," presented by the Hon. East India Company.

A specimen of tho Ornithorhyncus, from Australia, presented by Mr. Maurico Baldwin, of Toronto.

Twenty-four volumes of Bohn's Scientific, Standard, Antiquarian, Classical, and Illustrated Library, presented by H. G. Bohn, Esq., London, through A. H. Armour, Esq., Toronto.

The Census of tho United States, and tho Documentary History of the Stato of New York, presented by A. H. Armour, Esq.

The thanks of the Council were ordered to be transmitted to the Honourablo East India Company, Mr. Maurice Baldwin, Mr. Bohn, and Mr. Armour, for their respective donations.

Mr. Richard Denison, of the township of York, and Mr. George Wilson, of the City of New York, United States, were proposed members of the Institute.

COUNCIL MEETING, AUGUST 9TH, 1854.

The following Donation from A. H. Armour, Esq., Toronto, was announced:—

Schoolcraft's History, Condition and Prospects of the Indian Tribes; Parts First, Third, and Fourth.

Report of the Superintendent of the United States Coast Survey for tho year 1852.

Report of tho Commissioners of Patents for the year 1853; Part 1., Arts and Manufactures.

Mr. Armour's donation was accompaniod by a lotter, informing the Council that he was indebted to tho liberality of the Hon. G. W. Manypenny, Commissioner of Indian Affairs, the Hon. J. M. Brodhead, Washington, and Ellicott Evans, Esq., Buffalo, for the above-mentioned valuable works.

The following resolutions were ordered to be transmitted to Mr. Armour:—

"*Resolved*--That the best thanks of the Council be tendered to Mr. Armour for his valnable donation, and for his constant and active zeal in promoting the interests of the Institute."

"*Resolved*,—That the thanks of the Council be tendered to the gentlemen mentioned by Mr. Armour as having so liberally assisted in obtaining this valuable addition to the Library."

COUNCIL MEETING, AUGUST 23RD, 1854.

The following gentlemen were proposed members:—

Mr. J. U. Thomson.. Toronto.
Mr. D. B. Reid... "
Mr. D. O. French.. "

"*Resolved*,—That the thanks of the Council be transmitted to Lieutenant A. Noble, R.A., for his valuable Monthly tables of the Meteorology of Quebec, communicated by him to the Canadian Journal, and that the Council desire to express their regret at the suspension of the Quebec table, on account of the removal of Lieutenant Noble to Montreal.

"*Resolved*,—That the thanks of the Council be transmitted to Dr, Smallwood, St. Martin, Isle Jesus, and to Professor Cherriman, Director of the Provincial Magnetic Observatory, for the valuable monthly Meteorological tables of Isle Jesus and Toronto.

Robert Stephenson, M.P.

The Library of the Canadian Institute has recently been enriched by contributions from various sources. Appropriate acknowledgments of this encouraging liberality—which is rapidly creating a permanent and most valuable adjunct to the Institute—have been duly inserted in the extracts from the Minutes of Council. It is with great pleasure that we have to announce in addition to recent contributions already noticed, a most valuable donation from the distinguished engineer, Robert Stephenson, Esq., M.P.

Mr. Stephenson's donation consists of the celebrated work on "The Britannia and Conway Tubular Bridges, with general inquiries on Beams and on the Properties of Materials used in construction, by Edwin Clark, resident Engineer. Published with the sanction, and under the supervision, of Robert Stephenson."

A magnificent folio volume of plates, illustrating the Britannia and Conway Tubular Bridges.

The Quebec Meteorological Table.

The Meteorological Table for Quebec, which has been kindly furnished to this Journal for several months past by Lieutenant A. Noble, R.A., will no longer appear in its usual place. It is with great regret that we make this announcement. as we conceive that the absence of so important a link in the chain of Meteorological observation, which has hitherto been so well sustained, will be seriously felt by all interested in this department of Science. The occasiou of the suspension of the Quebec observations is the removal of Lieutenant Noble to Montreal. The Council of the Institute have expressed their sense of Lieutenant Noble's active exertions in the cause of Canadian Meteorology, by transmitting to him their thanks for his monthly contribution to this journal. A copy of this resolution, as well as of one transmitted to Dr. Smallwood, of St. Martin, Isle Jesus, and Professor Cherrimau, Torouto, will be found in the Extracts of the Minutes of Council.

Geological Map of a portion of Western Canada.

We are most reluctantly compelled to issue a considerable quantity of the August number of this journal with *uncoloured* geological Maps and sections illustrating Mr. Logan's valuable paper on the Physical Structure of the Western District of Upper Canada. . Notwithstanding every effort made to ensure and expedite the rather tedious process of carefully colouring many hundred Maps with not less than fourteen different tints, we have been disappointed in procuring the requisite number. We have preferred, however, to publish the full complement of our present issue, rather than disappoint by delay a considerable proportion of the members of the Institute, as well as Subscribers to the Journal. This determination has been less reluctantly adopted on account of the expressed intention of the Council to furnish all those gentlemen whose names are now upon the books of the Institute, with a coloured copy of Mr. Logan's Map, as soon as they are completed.

Miscellanea.

Gold Mining in England—Extraction of Sulphur—Age of Man on the Earth—Sewage Manure—Electric Colour Company—Crystal Palace —Wheeling Suspension Bridge—Trade Museum in London—Wisconsin Lead—Longitude of Cambridge—New Planet—Moon's Surface—Specula of Telescopes—Columbiades—Iron Furnaces in Great Britain —Revenue, Expenditure, and Commerce of Great Britain—Cotton from India—Casualties at Sea—Egyptian Railroad—Madame Sontag—Canadian Exports to Oswego.

Gold Mining in England is a failure. The auriferous gossan of the Poltimore appears to be already practically exhausted. Strong suspicions of "Salting" the specimens upon which the examinations were made and reports founded, are expressed. The gold Mining share market (England) is in a very depressed condition. A general want of confidence exists in all Quartz Mining Gold Companies. This feeling extends both to California and Australia.

Several Companies have been formed in England for the extraction of Sulphur from various Minerals. This is a consequence of the eccentric manœuvre of the King of the Two Sicilies, who declared Sulphur one of the articles contraband of war,—and hence prohibited its exportation from his dominions, much to the discomfiture of a vast multitude of chemical and other manufacturers in England. The annual consumption in Great Britain and Ireland, amounts to 60,000 tons, which at £5 a ton, equals £300,000 a year. It appears, however, that owing to the remonstrances of her Majesty's Minister at the Court of Naples, the King has removed the prohibition regarding the export of Sulphur, which is only considered contraband of war according to circumstances, and the port to which it may be conveyed; and that when sent out in its native or unmanufactured state, it may be presumed to be destined for peaceful and not warlike purposes, especially when shipped to a mercantile port—all vessels being allowed to convey it, with the exception of native bottoms,

The Mining Journal says that the volcanic Sulphur, which we have hitherto obtained from Sicily, owing to its freedom from impurities, has been of great importance to us in several of our manufanufac-for many purposes. Were we to avail ourselves of the resources we possess at home, in a great measure we should be independent of the supply derived from foreign sources.

It is with considerable satisfaction we see that the question has already excited some interest among many influential people connected with our home mines. A company has been formed at Conway for working the Sulphur in that district, which, it is stated, is nearly free from any deleterious mixture. Several other associations are in course of formation for the same purpose. Mines in Wales which are not profitable for copper would, if worked for sulphur, become paying; and the refuse which is thrown away in Cornwall might be likewise rendered available. In several of the States of Germany, where mining operations are carried on by a very simple process, a comparatively pure Sulphur is obtained from the mundicy ores there produced.

In an essay just published, Dr. Usher, an American geologist, unhesitatingly pronounces on the age of man on the surface of the earth, from remains, found more especially in America. Speaking of the remains of a single human being found on the banks of the Mississippi, at a depth of 16 feet in the soil, he says, from this it appears that the human race existed in the delta of the Mississippi more than 57,000 years ago.

Prof. White, agricultural chemist, and Mr. Henry Stothert, patentee, of the Sewage Deodorising and Patent Manure Company, have had an interview with Viscount Palmerston, for the purpose of submitting to his Lordship specimens of oats and barley grown upon clean sand, and cultivated by means of pellucid sewage water.

The Electric Power, Light and Colour Company, are advertising their Colours and state that they are prepared to supply the trade with Colours unequalled in quality and lowness of price. A notice of this important manufacture will be found in the 1st vol. of the Canadian Journal.

Twenty thousand three hundred and seventy Season Tickets of the Crystal Palace, Sydenham, have been sold up to July 7th.

A Boston journal says, that the original cost of the Wheeling Suspension Bridge, which was blown down in a heavy gale some weeks since, was $170,000, and the damage occasioned by its recent fall was about $100,000. The towers from which it was suspen ed rise 153½ feet above the low water level of the Ohio River on the Wheeling side, and 132¾ ft. high on Zane's Island. The Bridge flooring in the centre of the river was 93 feet above low-water mark—or so low that in times of great freshets some of the river steamers, with their tall chimneys, were unable to pass beneath it. The bridge was suspended from ten cables, each composed of 550 strands of No. 10 wire, and two smaller cables of 140 strands each. The cables were 1380 feet long from anchor to anchor, and were estimated, by Mr. Ellett, the builder, to be capable of supporting a weight of 297 tons, equal to 4000 men. The length of the span was greater than any other suspension bridge in the world.

The Council of the Society of Arts have determined to organize a Trade Museum. Her Majesty's Commissioners of the Great Exhibition of 1851, have agreed to co-operate most cordially with the Council of the Society of Arts, and to contribute annually out of their surplus funds in aid of a simultaneous collection of materials for the several branches of the proposed Trade Museum. The Smithsonian Institution at Washington has undertaken the general agency for the United States, and it is said that promises of assistance have been received from influential parties in the British Provinces. In an article on this important subject, the Mining Journal gives the names of gentlemen in England, Europe and India, whose active co-operation has been solicited or tendered. We should like to know how far and by whom Canada is represented in this undertaking.

In the same paper we find that irrespective altogether of the intended Trade Museum, the Society opened, in St. Martin's Hall, on the evening of Tuesday, the 4th July, their Educational Exhibition of Apparatus and School Literature, contributed by nearly 400 exhibitors. A numerous body of its members assembled for the special purpose of meeting Prince Albert, the president of the society. The exhibition is now open to the public ; several commissioners have been appointed by Foreign Governments to visit, inspect it, and report on its results.

The visitor will find it exclusively devoted to educational advancement, and although to a certain extent experimental, and the arrangements as yet incomplete, it must prove pre-eminently useful in centralizing for public inspection the evidences and examples of all the most approved systems, for the benefit of all engaged or interested in educational pursuits. Those who come in the hope of such attractions as dazzle by the glare of their splendour at Sydenham, will be disappointed ; the design, the arrangements and the display are purely utilitarian, the avowed object being the improved condition of the people.

During the past 12 years, the quantity of lead produced from the Wisconsin Lead region alone was 7,103,448 pigs, weighing 497,241,360 lbs., and realizing $16,657,989. The yearly returns have varied from 425,814 pigs to 778,498, or from 28,603,960 lbs. to 54,494,862 lbs.

At a late meeting of the Astronomical Society, Professor Challis read a paper on "the Determination of the Longitude of Cambridge, from observations by Galvanic signals, it was stated that the result was obtained from 281 signals, which gave the final determination of the longitude of Cambridge Observatory at 22·°69 east. This determination is 0·°85 *less* than that which had been used, and upon which

no suspicion at all rested of being in error to any thing like that amount.

Mr. J. R. Hind, London, has discovered another new planet. It is like a star of the tenth magnitude, and is situated almost exactly upon the ecliptic, about midway between two stars of the fifth magnitude—29 and 32 of Hamsteed in Capricornus.

The Earl of Rosse says, that he does not believe there is any known photographic process, which is sufficiently sensitive to give details of the Moon's surface in the least degree approaching to the way in which they are brought out by the eye.

The same Nobleman in a letter to the Astronomer Royal, a portion of which is published in the Athenæum of June 17th, says, in relation to specula for telescopes:—"You recollect, no doubt, how greatly superior silver would be to speculum metal, if it could be as well and and as easily polished as speculum metal. At the Ipswich meeting of the British Association, I described a process which had been, to a certain extent, successful. It is difficult, however, and uncertain; and as a silver surface is very perishable, it would scarcely be worth while to employ it, except under special circumstances. Another method which I have very recently tried is perfectly easy, and promises well. A plate of glass is coated with silver by precipitation from saccharate of silver. The silver film is then varnished with tincture of shell-lac, and when dry, the temperature of the glass is gradually raised to the fusing point of shell-lac. Pieces of shell-lac are then laid upon it, and over them a piece of thick glass. A slight weight presses out the superfluous shell-lac, and the whole having gradually cooled, the silver film adheres permanently to the shell-lac, the glass upon which it had been originally precipitated being easily removed without injuring it. We have thus a silver surface apparently as true as the glass upon which it has been precipitated, and with a beautiful polish. The experiment is imperfect so far as this, that as yet merely common plate glass has been tried, and not a true glass surface: and as I am about to set out for London, I shall have no opportunity for some time of completing these experiments. With the view of applying Mr. Lassell's levers to one of our 6-foot specula, should there be a reasonable prospect of improving its performance in that way, I have tried some experiments as to the practicability of drilling speculum metal. I find it can be drilled by a tubular drill of soft iron and emery, the core being from time to time removed by a pointed chisel, and a very light hammer, by which it can be safely broken up gradually. A drill with diamonds set in a groove, cuts it well also; and even a drill of perfectly hard steel, revolving slowly, cuts it well; so that there can be no serious difficulty in making the necessary perforations."

At the Fort Pitt works, Pittsburg, the proprietors are engaged on a Government order for 21 guns of the heaviest calibre, called "Columbiades," having a ten-inch bore and throwing a 124 pound shot. Lieutenant Rodman is the inventor of a new principle in casting ordnance. The cannon is cast hollow, and a constant and ever-renewed stream of water forced in, thus cooling the interior first instead of, as was the old plan, casting solid and allowing the outside to cool first. Cannon cast by both methods have been subjected to powerful tests, and it is found that those cast on the new principle bear five and six times the number of charges of those cast by the old method.

In the year 1806 the total number of Iron Furnaces in Great Britain was 216 and the production 243,851 tons; in 1852 the total number of Furnaces was 655 and the production 2,701,000 tons.

A Parliamentary paper just printed contains the following satisfactory statements relative to the Revenue, Expenditure and Commerce of the United Kingdom.

In the year 1853 the surplus of revenue was 3,254,505*l*. being the largest excess for ten years. The net amount of the several branches of the revenue of the United Kingdom paid in the exchequer was 54,430,344*l*. The expenditure of the revenue paid in the same year was 51,174,839*l*. In 1853 the taxes repealed or reduced amounted to 3,247,474*l*. and the estimated amount imposed was 3,356,383*l*. At the end of last year the balances in the exchequer were 4,485,230*l*. The capital of the national debt last year was 770,-923,001*l*. The quantity of raw cotton imported last year was 895,266,-780*l*, and of wool, 111,396,445*l*. The total declared value of British and Irish produce exported last year was 93,357,306*l*. Last year the number of vessels built and registered was 798, of 293,171 tons. The number of vessels belonging to the United Kingdom last year, exclusive of river steamers, was 18,206, of 3,730,087 tons, and the men employed, exclusive of masters, was 172,525. The coinage in the year was 12,664,125*l*. The births in the year were 612 341, the deaths 421,775, and the marriages 162,135. The total paupers relieved were 818,315.

There appears to be no longer any doubt as to the capabilities of India to supply the United Kingdom with cotton. The London *Morning Chronicle* considers it as demonstrated beyond all question, that India can furnish cotton for the British Market. The inferiority of Indian Cotton compared with American arises from what befalls it subsequently to its production in the fields. Railways for transportation, and an improved method of collecting, cleaning, and packing are all alone required to enable Central India to furnish an immeuse and continually increasing supply.

In a list of casualities to British Shipping taken from a Parliamentary blue book, the startling fact is announced, that during the four years ending 1850, not less than 204 ships and their crews departed from the various ports of the United Kingdom, of which *not one was ever heard of again.*

The *Daily News* says, that the Egyptian Railroad is in good working order, and answers exceedingly well. The trains do not run on it at present at any stated periods. It is chiefly used when European or Indian passengers arrive in Egypt. English engine drivers are employed on it. The speed is about 20 miles an hour. The railway the whole distance between Alexandria and Cairo will soon be open. It passes through a level and most fertile country The Arabs do not know what to make of it. They were dancing before it some time since, and having no conception of its speed, they did not get out of the way in time, and an Arab woman was killed.

Madame Sontag, who died in Mexico, on June 18th, was forty-eight years old, having been born at Coblentz, on the 13th of May, 1805. She was the child of an obscure German actor and actress. She married a foreign gentleman of noble family, and until 1848, did not appear on the public stage. As one of the consequences of the Revolution of 1848, Madame Sontag was compelled by the vicissitudes of fortune to return to the Opera Houses of Europe.

In Hunt's Merchant Magazine, under the head "Foreign Trade of Oswego," we find the following statement:—"There has been a handsome aggregate increase, although there has been a falling off in the Importations of Canadian flour, of near one-half, as compared with last year. The cause of this we have before explained, the principal one *being the reciprocal free trade adopted between the Provinces, which has tended to divert Canadian Flour from our channels down the St. Lawrence.*" The deficiency at this point this year. is made up by the increased receipts of Canadian wheat. The receipts of three articles of largest import, from Canada for two seasons, have been as follows:—

		1852.	1853.
Flour	barrels	193,190	113,008
Wheat	bushels	1,362,482	1,781,157
Lumber	feet	75,500,000	121,288,329

Large amounts of the products of the forests, such as shingles, lath, railroad ties, oak and pine timber, &c., imported at this point, are not embraced in the above lumber figures.

Supplying Locomotives with Water.—A resident of Fredonia (N. S.), has invented a curious apparatus for supplying locomotives with water, according to which, a cistern must be constructed beneath the track, having connected with it a force pump, which in its turn is connected with a series of "friction wheels," inserted above it in the track. The locomotive is run upon these wheels, and then, however swiftly its wheels may revolve, it can go no further, as the friction wheels upon which it stands revolve with those of the engine. The force pump is in this manner set at work, and made to raise from 1500 to 5000 gallons per minute.

Properties of Iron.—The Philadelphia *Ledger* states, that in the concluding lecture of Prof. Smith at the Smithsonian Institute, the lecturer dwelt upon the tendency of iron to undergo a change from a fibrous to a granular condition—thus causing the abstraction of an indefinite amount of its tenacity and strength. Fibrous iron, by being for a considerable time subjected to concussion, will become granular and therefore weak. A knowledge of this principle has induced the French government to disallow the use of iron axles on their public *diligences* beyond a certain time; they must then be removed. Iron cannon, originally very strong, become weaker and weaker by use, from the loosening of the texture of their substance.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—June, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Magnet.	Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch	Snow in Inch.
						°	°	°	°														
a	1	29·940	29·928	29·897	29·919	47·4	60·2	49·4	54·25	0·236	0·300	0·266	0·269	·75	·59	·77	·66	E	S E b E	E	3·01	...	...
a	2	·918	·831	·769	·832	52·3	66·8	54·2	58 55	·251	·348	·262	·289	65	54	64	60	N N E	S S W	S S W	2·60	...	...
a	3	·773	·716	·658	·709	53·2	71·1	57·1	62·28	·319	· 395	·335	·370	81	53	73	69	Calm	S	Calm	1·72	...	...
a	4	·647	·593	—	—	56·7	75·2	—	—	·316	·402	—	—	70	48	—	—	Calm	S	—	2·59	...	...
a	5	·553	·505	·480	·511	60·5	77·9	61·3	67·28	·360	·501	·414	·434	69	54	78	68	N b W	W N W	Calm	1·91	...	...
a	6	·493	·392	·398	·427	59·6	67·4	57·1	60·67	·376	·413	·367	·378	75	63	80	73	E	E	E N E	5·97	0·085	...
a	7	·396	·374	·385	·384	56·9	71·3	55·2	60·05	·417	·342	·367	·402	92	73	86	86	N E b E	S E b E	E b N	5·69	0·085	...
a	8	·310	·290	·334	·308	49·8	53·0	55·6	53·60	·338	·351	·410	·380	96	89	95	94	E S E	E S E	S W b S	2·80	0 635	...
a	9	·349	·388	·544	·437	53·6	57·9	54·2	56·08	·366	·459	·379	·411	90	97	91	92	S W b W	S S W	N N W	3·91	0·055	...
a	10	·654	·729	·712	·703	54·0	64·9	57·3	59·75	·390	·467	·422	·430	96	78	92	86	N b W	S W b S	Calm	4·17	...	...
c	11	·677	·648	—	—	55·6	64·6	—	. —	·362	·468	—	—	84	79	—	—	W b S	S E b E	—	3·82	...	...
e	12	·588	·523	·498	·535	60·7	72·2	57·8	63·92	·447	·506	·389	·453	86	65	83	78	N E b N	S	Calm	2·69	...	...
b	13	·500	·460	·512	.490	61·7	74·7	60·0	66·80	·413	·503	·465	·459	77	61	91	73	N b W	S W b S	Calm	3·59	0·105	...
b	14	·533	·496	·504	·507	58·1	77·2	66·9	67·92	·393	·572	·419	·439	83	64	65	66	W	S S W	W S W	3·63	0·020	...
c	15	·528	·490	·586	·539	69·3	80·0	63·5	70·62	·556	·618	·423	·514	80	62	75	70	W S W	S S W	N b E	4·90	...	...
c	16	·718	·765	·771	·750	57·4	68 9	51·4	59·87	·312	·389	·301	·347	68	57	80	69	N N E	S	S E	3·17	...	...
b	17	·814	·739	·682	·738	52·7	67·6	51·3	58·50	·313	·324	·231	·301	80	49	63	64	S E b E	E b S	E N E	4·50	...	...
a	18	·649	·566	—	—	59·4	72·2	—	—	·371	·518	—	—	75	68	—	—	N E b N	S E b E	—	1·68	...	...
b	19	·593	·608	·602	·601	66·1	79·1	65·4	71·45	·450	·656	·474	·546	72	68	77	72	N W b N	W N W	Calm	3·00	...	...
a	20	·641	·611	·565	·607	66·4	71·6	63·5	67·82	·473	·410	·407	·432	75	55	71	66	N N E	E S E	E N E	5·05	...	...
a	21	·513	·412	·393	·434	63·0	68·6	61·9	63·92	·462	·471	·441	·462	82	70	82	80	E b N	E b N	E b N	5·70	Inap.	...
a	22	·429	·451	·468	·454	63·0	76·8	60·4	66·37	·427	·600	·415	·471	76	68	81	74	Calm	S E	Calm	2·90	0·090	...
c	23	·391	·462	·517	·466	59·8	66·6	57·8	61·83	·444	·486	·396	·447	88	76	85	83	E N E	N	N W	4·65	0·255	...
a	24	·516	·524	·649	·563	58·5	71·1	56·5	62·08	·394	·569	·393	·452	82	77	88	82	N W b W	N N W	N b W	6·38	...	...
*	25	·67[illegible]	·639	—	—	58·7	72·1	—	—	·378	·494	—	—	78	65	—	—	N b W	S b W	—	3·77	...	...
—	26	·504	·415	·453	·457	63·5	84·0	73·7	75·67	·469	·834	·620	·673	82	74	78	77	S S W	Calm	Calm	†	...	...
—	27	·600	·536	·469	·530	67·1	81·3	64·8	70·33	·513	·707	·487	·544	80	68	82	75	E	E S E	Calm	...	...	...
—	28	·400	·461	·572	·481	73·0	86·9	59·2	73·00	·727	·342	·403	·498	93	28	82	67	S	N W	N W b N	9·85	...	...
—	29	·586	·520	·337	·467	60·9	69 6	63·2	63·97	·375	·510	·512	·460	72	73	91	79	Calm	Calm	E b N	1·15	0·130	...
—	30	·316	·483	·650	·499	66·4	77·0	62·6	68·57	·520	·408	·422	·444	83	46	76	67	N W	N N W	N b W	10·45	...	...
																		Miles.	Miles.	Miles.	Miles		
	M	29·562	29·544	29·551	29·5514	59·86	71·70	59·39	64·12	0·414	0·476	0·401	0·434	81	64	80	74	3·50	6·44	2·05	4·12	1·460	0·0

Highest Barometer...... 29·955, at 8 a.m. on 1st } Monthly range:
Lowest Barometer....... 29·287, at midnight on 29th } 0·668 inches.

Highest registered temperature 92°·5, at p.m. on 26th } Monthly range:
Lowest registered temperature 35°·2, at a.m. on 1st } 57°·3.

Mean Maximum Thermometer.............. 74°·50 } Mean daily range:
Mean Minimum Thermometer....... ...... 49°·84 } 24°·66.

Greatest daily range......... 41°·8, from p.m. of 28th to a.m. of 29th.

Warmest day....... 26th. Mean temperature...... 75°·67 } Difference,
Coldest day......... 8th. Mean temperature...... 53°·60 } 22°·07.

Aurora observed on 2 nights.
Possible to see Aurora on 21 nights.
Impossible to see Aurora 9 nights.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.†

North.	West.	South.	East.
1123·86	790·73	618·68	983·62

Mean direction of the Wind, N 10° E.
Mean velocity of the Wind, 4·12 miles per hour.
Maximum velocity, 33·4 miles per hour, from $3\frac{1}{2}$ to $4\frac{1}{2}$ p.m. on 28th.
Most windy day, the 30th; mean velocity, 10·45 miles per hour.
Least windy day, the 29th; mean velocity, 1·15 " "
Raining on 9 days. Raining 26·2 hours: depth, 1·460 inches.
Greatest intensity of Solar Radiation, 95°·2 on 28th } Range, 63°·0.
Lowest point of Terrestrial Radiation, 32°·2 on 1st }
4th. Fire Flies first observed this season.
12th. Wild Strawberries ripe.
23rd. Yellow matter (Pine Pollen) fell in the rain this day.
Thunder Storms occurred on the 7th, 8th, 13th, 14th and 23rd.
The quantity of rain recorded for this month is the least for any June during the last 15 years.

Comparative Table for May.

Year.	Temperature. Mean.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Snow. D'ys	Inch.	Wind. Mean Vel'y.	
	°	°	°	°						
1840	60·0	78·5	37·1	41·4	11	4.860	0	...	...	
1841	65·6	92·8	45·7	47·1	9	1·560	0	...	0·36	lb.
1842	55.6	73·9	28·0	45·9	15	5·755	0	...	0·31	lb.
1843	58·4	81·3	28·5	52·8	12	4·595	0	...	0·27	lb.
1844	59·9	82·8	33·1	49·7	9	3·535	0	...	0·19	lb.
1845	61·0	83·6	40·9	42·7	11	3.715	0	...	0·27	lb.
1846	63·3	83·3	41·5	41·8	10	1·920	0	...	0·32	lb.
1847	58·4	78·3	36·7	41·6	14	2·625	0	...	0·30	lb.
1848	62·9	92·5	38·3	54·2	8	1·810	0	...	4·51	Miles.
1849	63·2	84·9	45·2	39·7	7	2 020	0	...	3·32	Miles.
1850	64·3	83·2	49.0	34·2	10	3·345	0	...	4·54	Miles.
1851	59·2	79·2	41.2	38·0	11	2·695	0	...	4·42	Miles.
1852	60·8	86·1	43·6	42 5	10	3·160	0	...	4·09	Miles.
1853	65·5	86·3	43·3	43·0	9	1·550	0	...	3·67	Miles.
1854	64·1	88·7	47·4	41·3	9	1·460	0	...	4·12	Miles.
									0·29	lb.
M'n.	61·48	83·69	39·97	43·73	10·3	2·974	0·0	0·00	4·10	Miles.

* Magnetic instruments dismounted on the 25th; magnetic character of the day deficient from that date.

† The record of the components of the Wind—the mean direction and the velocity are not complete for the 26th and 27th of this month, on account of removing the position of the Anemometer during the rebuilding of the Observatory.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——June, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10. P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	30·047	30·031	30·015	41·0	74·2	54·5	·180	·393	·304	·64	·47	·70	N	W b S	W	0·29	0·80	0·65	...	Clear.	Clear.	Clear.
2	30.066	29·824	29·809	56·1	80·3	61·2	363	435	362	79	43	66	W b N	W b N	W b N	0·87	4·02	Calm	...	Do.	Cum. Str. 4.	Hazy.
3	29·813	·780	·741	60·0	84·0	66·4	360	533	373	68	47	58	W b N	W b N	W	Calm	Calm	0·09	...	Do.	Clear.	Clear.
4	·723	·647	·645	65·5	79·9	67·8	402	465	480	65	47	72	W N W	W	N W b W	0·28	0·57	0·12	...	Do.	Do.	Do.
5	·654	·652	·705	66·0	79·6	62·0	516	489	573	80	50	67	W b S	E N E	E N E	0·01	0·29	Calm	...	Cum. Str. 8.	Do.	Do.
6	·803	·761	·710	54·6	61·1	52·6	246	362	349	57	66	87	E N E	E N E	E b N	0·19	1·56	Calm	Inap.	Str. 8. Thunder	Str. 9.	Cum. Str. 8.*
7	·646	·669	·682	51·0	64·6	54·0	260	504	373	68	84	87	E b N	E N E	E N E	4·24	5·17	8·94	1·251	Rain. [at 11.	Str. 8.	Cir. Str. 9.
8	·617	·537	·699	49·0	53·1	50·0	336	386	350	93	93	98	E N E	E N E	E N E	21·45	7·21	30·43	1·566	Cum. Str. 10.	Rain.	Rain.
9	·496	·568	·668	50·0	53·0	52·1	552	386	361	99	93	94	E N E	E N E	E b N	9·30	6·45	15·67	3·252	Rain.	Str. 10.	Str. 10.
10	·733	·785	·847	53·5	65·9	58·1	361	499	462	87	80	94	N E	E b N	E	0·82	3·14	Calm	...	Cum. Str. 10.	Cum. Str. 4.	Cum. Str. 9.
11	·926	·923	·784	56·0	75·1	60·2	385	578	467	84	67	89	E	S S W	W S W	Calm	Calm	Calm	...	Cum. Cir. Str. 8.	Str. 2.	Clear.
12	·747	·760	·656	55·0	84·5	60·2	382	638	467	85	56	89	W	S W	W b N	Calm	1·24	Calm	...	Clear.	Cir. Str. 2. Dist.	Cir. Str. 2.†
13	·700	·684	·642	66·6	85·0	69·0	489	659	486	76	56	69	W b S	W b S	E b S	Calm	1·12	2·11	...	Do.	Clear. [thunder.	Str. 10.‡
14	·651	·641	·712	58·0	83·1	69·0	462	827	570	94	75	81	S E b E	W S W	W S W	2·24	Calm	Calm	...	Hazy.	Do.	Hazy.
15	·704	·660	·758	57·0	83·0	65·6	422	681	425	89	61	68	W N W	W b N	N N E	Inap.	1·00	2·46	...	Fog.	Hazy.	Do.
16	·964	30·074	30 068	53·2	69·1	52·0	274	351	326	66	49	81	N E	E b N	S W b W	5·14	1·18	1·01	...	Do.	Do.	Do.
17	30·135	30·047	29·924	53·6	70·0	59·1	315	628	402	76	86	79	N W	S W b W	S W b W	Calm	Inap.	Calm	...	Hazy.	Do.	Do.
18	30·010	29·848	·811	57·8	85·9	65·0	422	597	527	89	50	85	Calm	Calm	N W b W	Calm	Calm	Calm	...	Do.	Do.	Do.
19	29·818	·730	·801	65·0	87·8	64·0	586	854	534	94	68	89	W b N	N W	N W b W	2·42	6·12	6·30	0·100	Clear.	Str. 4. Distant	Str. 10.
20	·945	·912	·863	61·2	83·0	63·3	431	571	461	79	68	79	W S W	W S W	W S W	5·12	1·46	0·84	...	Do.	Clear. [thunder.	Clear.
21	·890	·836	·832	60·3	77·8	58·9	441	588	462	84	64	94	E b N	E N E	E b N	1·96	3·26	2·75	...	Do.	Do.	Overcast.
22	·899	·921	·921	57·0	68·8	64·6	451	523	504	96	76	84	E b N	S S W	S S E	1·80	6·26	2·87	...	Do.	Cir. Cum. Str. 9.	Cir. Str. 9.
23	·899	·812	·766	60·1	66·7	63·0	512	574	520	98	89	90	S b E	S S E	S b E	2·77	4·90	4·50	0·540	Rain.	Str. 8.	Cir. Str. 9.§
24	·707	·658	·796	60·6	76·0	60·0	521	659	467	99	74	89	S b E	W S W	N	0·11	2·00	7·37	0·088	Cir. Str. 8.	Cum. Str. 4.	Cir. Str. 10.
25	·893	·874	·847	52·0	68·9	57·2	291	541	398	78	76	84	N E b N	W S W	W S W	11·41	3·79	4·50	...	Str. 8.	Cum. Str. 2.	Cir. Str. 2.‖
26	·893	·726	·773	59·0	65·1	60·4	452	586	511	89	94	96	W	S S W	W N W	0·50	8·25	Calm	0·231	Clear.	Rain.	Cir. Str. 4.
27	·929	·852	·773	62·7	83·0	68·6	472	910	582	84	82	85	N N E	N E b E	N E b E	0·67	0·68	Calm	...	Cir. 2.	Cir. Str. 4.	Cum. 4.
28	·611	·581	·821	69 0	80·0	65·4	668	692	449	95	69	72	S S E	S W	N W b W	0.53	8·34	8·34	0·290	Cum. Str. 9.	Do. 9. Thunder.	Cir. Str. 8.
29	·936	·903	·768	58·3	75·0	63·0	346	550	516	70	64	84	N W	S W	S E	2·65	Inap.	0·15	...	Clear.	Clear.	Light Cirrs.
30	598	·598	·827	60·0	60·2	57·2	500	694	472	96	94	99	N E b N	N W b N	W N W	1·25	4·28	6·80	1·066	Rain.	Cum. Str. 8.	Clear.

Barometer	Highest, the 17th day	30·135
	Lowest, the 8th day	29·499
	Monthly Mean	29·814
	" Range	·636
Thermometer.	Highest, the 19th day	89°·0
	Lowest, the 2nd day	42°·4
	Monthly Mean	63°·8
	" Range	46°·6
	Mean Humidity	·780
Greatest Intensity of the Sun's Rays		130°·1

Rain fell on 10 days, amounting to 8·384 inches, and was accompanied by thunder and lightning on 4 days. Raining 48 hours, 5 minutes.

Amount of evaporation, 2·95 inches. The greatest amount of evaporation observed here was during the first 6 days of this month, and amounted to 1 inch.

Most prevalent Wind, E N E. Least prevalent Wind, N.

Most Windy Day, the 8th day; mean miles per hour, 23·03.

Least Windy Day, the 18th day; mean miles per hour, 0·0.

Aurora Borealis visible on 2 nights. Might have been seen on 13 nights.

The electrical state of the atmosphere has been marked by rather high intensity during the month, varying frequently from positive to negative.

* Thunder and lightning at 8·45 p.m. † Faint Aurora Borealis. ‡ Distant thunder and lightning. § Lightning. ‖ Faint Aurora Borealis.

The Canadian Journal.

TORONTO, SEPTEMBER, 1854.

On a New Smoke-Consuming and Fuel-Saving Fire-Place,

With Accessaries Ensuring the Healthful Warming and Ventilation of Houses.

BY NEIL ARNOTT, M.D., F.R.S.

(*Continued from page* 6.)

DEFECTS OF HEATING AND VENTILATING.

The third and last of the great evils of the present open fires is, that there are great irregularities and deficiencies in their heating and ventilating actions, which bear so powerfully on the public health. The hood and its damper, as influencing these, may appear perhaps of more importance than as saving the fuel.

The hood and its damper, by allowing so small a quantity of air to pass through in comparison with what rises in an open ordinary chimney, lessens in the same degree the cold draught of air towards the fire from doors and windows, and which are common causes to the inmates of winter inflammation and other diseases; and for the same reason, the heat, once radiated from the fire towards the walls of the room, not being again quickly absorbed and carried away by such currents of cold air as are referred to, remains in the room, and soon renders the temperature of the whole more equable and safe.

Still more completely to prevent cold draughts approaching from behind persons sitting around the fire, the fresh air for the room is conveniently admitted, chiefly by a channel which leads directly from the external air under the floor to the hearth, and there allows the air to spread from under the fender. The fender, exposed to the fire near it, becomes hot; the cold, fresh air then rising under it, takes from it the excess of its heat, and so becomes itself tempered before it spreads in the room. The two evils of excess of heat and excess of cold meet to neutralise each other, and to produce a good result.

The importance of general ventilation, again, is strikingly exhibited by such occurrences as the following, which was related at the meeting of scientific friends at which I first described the new fire-place, by Mr. Robert Chambers, of Edinburgh, as having happened not long ago in Glasgow. A large old building, which had been formerly a cotton-mill, was fitted up as a barrack or dwelling-house for persons of the working classes, and had nearly 500 inmates. Like all foul and crowded human dwelling, fevers and kindred diseases soon became prevalent there. After a time, a medical man who was interested obtained permission from the proprietors of the neighbouring chemical works, in which there was a lofty and very powerful chimney, for the ventilation of the lodging-house. He then connected with this a main tube from the lodging-house, which had branches running along all the passages or galleries, and from the ceiling of every separate room a small tube communicated with these branches. Soon after, to the surprise as well as to the delight of all concerned, severe diseases entirely disappeared from the house and never returned.

Now, the chimney of the new fire-place, although not very tall, has a ventilating power scarcely inferior to that of the Glasgow chemical works. The arrangement of the hood and its valve, as above described, by allowing only unmixed and very hot smoke to enter the chimney, instead of, as in common chimneys, smoke diluted with many times its volume of colder air, increases the draught just as it does the heat of the chimney, and through an opening then made into the chimney from near the top of a room, all the hot, foul air in the room, consisting, perhaps, of the breath of inmates, smell of meals, burnt air from candles, lamps, &c., and which else accumulates and stagnates at first near the top of the room, is immediately forced into the chimney and away. This is strikingly proved by placing near the ventilating opening a light body, as feathers or shreds of paper suspended to a thread, and seeing with what force it is drawn into the opening. In the diagram the opening is represented at the letter *v*, having the common balanced chimney-valve in it, which, by the wire descending to a screw within reach of the hand, can be left open to any desired degree.

That valve I recommended many years ago, and its use has become pretty general over the country; but, in many cases, what I described as an essential concomitant—the contraction of the chimney-throat and the space over the fire—has been omitted.

This is what I had to say on the correction of the third of the great evils of the common fire, and I hope it has been shown to be possible to construct an open fire-place, scarcely differing in appearance from an ordinary English fire-place, with its pleasing associations, but which shall be smokeless, saving much fuel, and ensuring the healthful warmth and ventilation of our houses.

There are yet subordinate advantages of the new arrangement of fire-place, among which the following may be noted :—

1. Chimney-sweeping can scarce be wanted where there is no soot.

2. Chimney-flues without soot cannot catch fire; and if fire were in any way there introduced, by shutting the hood valve it would be certainly extinguished. Thus a large proportion of the conflagrations of buildings may be avoided.

3. The huge evil (almost universal) of smoky chimneys cannot occur with this grate.

4. The occasional sudden rush of air towards a hot wide chimney, when the door is opened, and which carries readily the light muslin dress of a lady towards the grate and inflames it, cannot happen with this grate.

5. The danger of sparks from exploded pieces of coal thrown on the carpet does not exist here, for all the coal is first heated and coked while deep in the coal-box, and covered over. Thus a fire-guard is not wanted on this account.

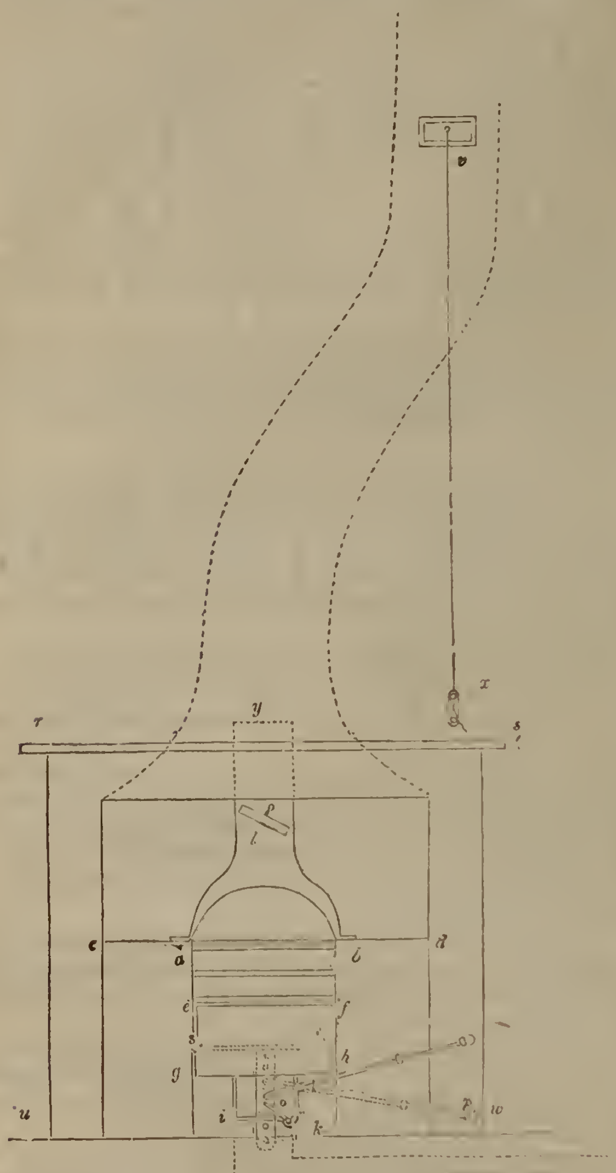
6. The strong draught of a voracious fire in one room, or in the kitchen of a house, cannot disturb and overcome the action of other chimneys in the house, which is now very common.

7. The strong draught of any well-constructed fire-place may, by a connecting tube be made to ventilate any distant rooms, staircases, cellars, closets, &c.

8. The strong and copious draught caused by momentarily opening the hood-valve or damper will prevent the diffusion of dust when the fire is stirred or disturbed.

9. The chimney-valve by its powerful ventilating effect, obviates all objections to the use of gas-lights in houses, thus leaving the beauty, cleanliness, cheapness, and many conveniences of gas unmarred. Explosion from accidental escape

of gas in a room or house, of which occurrence there have been some destructive instances, cannot happen where there is the ventilating chimney-valve, for cold coal gas entering a chimney-flue produces a more powerful draught than hot air does.



10. The improved chimney draught in attic or upper rooms will make these more valuable, and will increase the comfort of low houses and cottages.

11. It would, moreover, be convenient occasionally to carry the flue of a close stove, or bath, or the ventilating tube from lamps in staircases, into any acting chimney.

12. This torch-fire (as some have called it, because it burns from above downwards, like a torch or candle) is remarkably adapted also for the purpose of the kitchen

13. The change of any existing grate of an old fashion into this is easy and inexpensive, and by having a piston-plate with holes it can be used as a common grate.

14. Any kind of coal or coke may be used in this grate, even the small culm or coal-dust, which is very cheap. In a common grate, coke or Welsh stone coal would be objectionable, because containing chiefly heavy carbonic acid instead of the steam and carburetted hydrogen of bituminous coal, and the gas, which is poisonous, might spread in the room, but by the strong draught of the hood this could not happen.

I might extend this list, but I need not.

Before concluding, I may direct attention to the remarkable fact, only of late well understood, that of the only four great necessaries of life, or things which Providence has left to man in various parts of the earth to procure for himself, namely, fit air, temperature, aliment, and work alternating with rest,—the skilful management of a domestic fire goes far to secure the two first-named, viz., fit air and warmth; but these are the last which men come to understand well, because they are invisible and impalpable, and, therefore, to be perceived only by the eye of the mind after much cultivation.

The diagram represents a common fire-place, with mantel, *r s*, or chimney-piece, two jambs, and a common grate with two bars and bottom, to which four parts the essentials of the new fire-place are added. *e f g h* is a box or receptacle of iron to contain the charge of coal for the day with its open mouth placed where the bottom bars of the grate had been. It may stand on feet on the hearth, or may be fixed to the grate.—Besides its fixed bottom, *g h* it has also a moveable bottom, *s s*, like a piston, on which the coal immediately rests, and is lifted as wanted, or let down as the piston moves; a piston-rod passes through the fixed bottom, steadied by a guide-hole in the stirrup or bar, *i j*, below. The piston-rod has notches or openings in it to receive the points of the poker, *p o*, which acting as a lever, having its fulcrum in the foot of the box or otherwise, lifts the piston. A catch or pall, *k*, falls into the notches as the piston rises, to prevent its return until desired. In the centre of the bottom front is a door which is opened at will to admit a little air if wanted, or for removing small coal or ashes which fall past the piston. Where the grate is set low, a small opening is made in the hearth to allow the end of the piston to descend.

a b y is a hood or cover for the fire, like an inverted funnel opened in front, placed over the fire to contract the open space there, and to receive the true smoke of the fire and convey it little diluted into the chimney-flue at *y*. *t* is a valve or damper, placed in the narrow part of the stalk of the hood to give complete control of the current of air passing through. There is an index externally, showing clearly always the position of the valve. *y v* marks the direction of the chimney-flue in the wall, having generally to bend to one side to avoid the fire-place in the room above. *v* is the ventilating chimney-valve, admitting air from near the top of the room to the flue, balanced nearly on its centre of gravity, so that the least pressure from without opens it inwards, but any pressure from within, as of smoke, closes it. There is a wire descending from the valve, with a screw or loop-peg, for partially or wholly closing it. There is a channel underneath the hearth by which fresh air directly from the atmosphere, enters the room, to be warmed under the fender or near the fire, and then to spread in the room. It has a controlling valve.

Geology of Western Canada.

In the August number of this Journal we published a Geological Map of a considerable portion of Western Canada, by W. E. Logan,* Esq., F.R.S. & G.S., Provincial Geologist. We now propose to furnish monthly abstracts of those portions of the Geological Reports which describe the physical structure of the country comprehended within the limits of the Map. We are induced to adopt this method of disseminating information respecting the Geology of Canada, not only on account of its intrinsic value, but also because it is a matter of extreme difficulty to meet with copies of the earlier Reports, in consequence of the destruction of the reserve during those disastrous conflagrations which destroyed the Parliament Buildings at Montreal and Quebec.

Abstract of the Provincial Geologist's Reports, dated Montreal, April 28, 1844.

WESTERN DIVISION.—PRIMARY AND METAMORPHIC ROCKS.

In availing myself of the labours of the American Geologists to illustrate the general relations of the rock formations of the Province, it will be convenient to divide the subject into two parts, and drawing a line along the Hudson River and Lake Champlain to Missisquoi Bay and thence to Quebec, to consider the region to the west of this line separately from that on the south side of the Saint Lawrence to the east, there being certain conditions in the one that do not prevail in the other.

WESTERN DIVISION.

The Western Division, as connected with the Geology of Canada, may be described as a gigantic trough of fossiliferous strata, conformable from the summit of the coal to the bottom of the very lowest formations containing organic remains, with a transverse axis reaching from the Wisconsin River and Green Bay in Lake Michigan to the neighbourhood of Washington, a distance of nearly seven hundred miles; and a longitudinal one extending from Quebec in a south-westerly direction, to some point, with which I am unacquainted, beyond the Tenessee River in Alabama.* Contained within this vast trough and resulting from gentle undulations in the strata, giving origin to broad anticlinal forms, there are three important subordinate basins, in the centre of each of which spreads out an enormous coal-field. One of these extends in length from the County of Logan on the southern borders of Kentucky, in a north-westerly direction to the Rock River in Illinois, where it falls into the Mississippi, a distance of three hundred and sixty miles, and in breadth from the mouth of the Missouri to the County of Tippecanoe, on the Wabash in Indiana, two hundred miles. Presenting an oval form intersected by the River Illinois, Wabash and Ohio, and bounded by the Mississippi, which sweeps along nearly the whole of its western margin, this coal-field covers an area of 55,000 square miles. The second occupies the heart of the State of Michigan, and reaching 100 miles in an east and west direction from within thirteen leagues of the Lake of that name to Saginaw Bay in Lake Huron, and 150 miles in a north and south line from the neighbourhood of the Rivers Manistee and Ausable, to the source of the Grand River near Jackson, on the road between Detroit and St. Josephs, it exhibits an irregular pentagonal shape and comprises a superficies of 12,000 square miles. The third carboniferous area stretches longitudinally about 600 miles in a north-easterly course from the state of Tenessee to the north-eastern corner of Pennsylvania, where many outlying patches belong to it, and 170 miles transversely from the north branch of the Potomac in Maryland, to the south-eastern corner of Summit County in Ohio, just twelve leagues south of Cleveland on Lake Erie. It possesses a sinuous subrhomboidal form and spreading over a surface somewhat larger than the first named coal-field, may comprise about 60,000 square miles. The Ohio and its tributaries unwater nearly the whole of it, and the main trunk of this great river serpentines through the centre of the region for about 400 miles of the upper part of its course. The Susquehanna and its tributaries intersect the north-eastern extremity of the deposit, and the vallies of denudation in which these waters flow, assisting the effect of a series of nearly equidistant undulations in the strata, there break its continuity into the outliers alluded to, which generally rest on sinelinal mountain tops, in the interrupted prolongation of a number of narrow subsidiary troughs resulting from the undulation in question, and giving an irregular and deeply indented contour to the outcrop of the main body of the coal. The chief part of the outliers, as well as the main body of the deposit, and also the other two great coal-fields described, yield fuel of the bituminous quality; but to the eastward of the Susquehanna, there are three large outliers almost sufficiently important to deserve the designation of another coal-field, in which the fuel contained is of the anthracitic kind.

The undulations which have been mentioned, constitute an important feature in the structure of the country between the St. Lawrence and the Atlantic.* Their ridges or anticlinal axes preserving a remarkable degree of parallelism, have been traced for vast distances, ranging in a sinuous south-westerly, course from Lower Canada to Alabama. Crossing them from north-west to south-east, those farthest from the ocean are broad and gentle, but they in succession become more acute and prominent; and as they do so the dips on the north-west side of the axes increase in inclination in a more rapid ratio than those on the south-east, giving to the undulations the form of waves driven before a gale, until at length the former assume a perpendicular attitude and even present an inversion of the strata.

It is where the flexures reach the Apalachian chain of mountains that the phenomena of these overturn dips are exhibited, and there the undulations, becoming identified with the ridges and vallies of the chain, afford an explanation of the structure of this great range of highlands. The disturbances which have given origin to these mountains, as they affect the coal measures, must, of course, take their date subsequent to the carboniferous era: but, as may be gathered from what has been said, it is only on the south-east side of the third coal-field that the measures are violently corrugated and fractured. The north-west outcrop exhibits a comparatively quiescent condition, and it would appear from the regular coutour of the Illinois and Michigan deposits, that the disturbing forces had entirely died away before reaching them. It does not seem improbable, however, that the broad low anticlinal arch which separates these two from the other, may have some relation to the expiring effort of those forces, for although its axis cannot be called precisely parallel to the Apalachian undula-

* See the geological Map of the Middle and Western States, lately published by James Hall, Esq., one of the State Geologists of New York.

* See Professor H. D. Rogers' State Reports on the Geology of Pennsylvania.

tions, there are yet bends in it that seem to correspond with some of the curves of that chain of mountains. From Monroe County in Kentucky, this axis takes a gently sinuous course, running under Cincinnati, on the Ohio, to the upper end of Lake Erie : thence it curves to the upper end of Lake Ontario, where my assistant, Mr. Murrary, has observed its influence in deflecting the strike of the strata n the neighbourhood of Burlington Bay. It then enters the lake, under the waters of which it probably dies away towards the north shore.

From beneath the three great coal-fields which have been mentioned, the subjacent formations crop out in succession, surrounding their carboniferous nuclei with rudely concentric belts of greater or less breadth, according to the thickness or dip of the deposit, and taking a wider and a wider sweep as they decend in the order of superposition, while they conform at the same time in their superficial distribution to all the sinuosities and irregularities occasioned by geographical and geological undulations. The organic remains of these rocks proclaim them to be contemporaneous with the Silurian and Devonian epochs of Europe, including the old red sandstone; and the Pennsylvanian geologists compute that in their south-eastern developement they attain the aggregate thickness of about 30,000 feet. But in the State of New York, where the quiet condition of the northern outcrop affords an admirable opportunity of determining with certainty all the relations of the deposits to one another, not more than one third of that amount can be made out. It would seem, therefore, if the many complicated folds existing on the south-east side have occasioned no error in the estimate, that the formations must thin down greatly towards the north.

The fossiliferous formations, wherever they have been found in actual contact with the rocks beneath, appear to rest upon masses of the primary order. But the geologists of New York consider they have evidence of the existence of a series of non-fossilliferous sedementary strata, in a more or less highly crystalline condition, of an age between the two. As considerable difficulties, however, attend the question, it will be sufficient for the purposes of the present description to unite all the subjacent rocks, whether metamorphic or primary, and to class them under the latter denomination.

The lowest of the fossilliferous strata is a sandstone of variable quality, more purely silicious towards the bottom, and calciferous towards the top, which gives support to a thick and remarkably persistent deposit of limestone, strongly distinguished by its organic remains. This limestone thus becomes an admirable means of tracing out the perimeter of the great western area under consideration. From the north-west border of North Carolina, it sweeps in a broad belt across Virginia to the junction of the Shenandoah and Potomac. Thence traversing Maryland, it passes through Pennsylvania by Harrisburgh, on the Susquehanna, and Belvidere, on the Delaware, accompanied up to this point by the underlying sandstone. Diminished in its thickness, it thence crosses New Jersey, and reaching Poughkeepsie it passes up the valley of the Hudson and Champlain, keeping to the east of the river and the lake and attains the neighbourhood of Missisquoi Bay.—Entering Canada, it proceeds towards Quebec, and it reaches the vicinity of that fortress; but I am not yet aware of the precise spots at which it is visible in its course thither, farther that I have been informed stratified limestone answering its condition is quarried and burned in the Seigniory of St. Hyacinthe, east of the Yamaska River. As Quebec itself does not stand upon tha formation, it probably crosses the St. Lawrence higher up the stream; but it may be seen in the quarries of Beauport and farther down the river, and its limit in that direction is to be found near Cape Tourmeut, where the underlying primary rocks come to the water's edge. Turning at this point, and following the northern outcrop of the deposit up the valley of the St. Lawrence, it is found to run along the foot of a range of syenitic hills of a guiesoid order, which preserve a very even and direct south-westerly course, and down the flank of which the various tributaries of the great river are successively precipitated in rapids and cascades. On the Maskinongé the syenitic range is about twelve miles in a direct line from the St. Lawrence, on the Achigan about twenty, and it strikes the Riviére du Nord about a half a mile south of the village of St. Jerome.—Following this stream, the primary rocks, which are close upon its northern bank, gradually assume a course with less of southing in it, until they reach Lachute Mills, when their direction becomes nearly due east. Along this line from Cape Tourment, the basset edge of the limestone does not in all cases come quite up to the primary rock. There is occasionally a space left between the two for the sandstone beneath, and on the Riviére du Nord the calciferous part of this rock, capped by the limestone, is seen in several places in a well defined escarpment about half a mile from the syenitic range, dipping southward at an angle of six degrees, which is probably one or two more than the average inclination along the strike of the northern outcrop thus far traced.

Leaving the Riviére du Nord, at Lachute Mills the edge of the fossilliferous strata, still well defined by the rise of the primary rocks from below them, crosses the township of Chatham, pursuing a direct course to Grenville, on the Ottawa, where the calcareous deposit is seen at the upper end of the canal. A little above the village the primary range comes upon the river, which may correctly be considered the general division between the two until we attain the township of Hull. A bend in the Ottawa there, cutting deep into the limestone, leaves four to five miles breadth of it on its left bank, and the formation displayed in lofty precipices in the neighbourhood of Bytown, affords the magnificent scenery of the Chaudiére Falls. From personal observation I cannot speak of its course farther up the Ottawa, but I undertand it reaches the island of Allumet, and thence turning southward, runs through the townships of Packenham, Ramsay, and Drummond,—crosses the Rideau Canal in Rideau Lake in Elmsley, where, with the subjacent sandstone, it is seen in section at the Upper Narrows resting on the primary rocks and dipping to the north of east at an angle of four degrees,—and sweeping round the adjoining corner of Bastard and Young, traverses Elisabethtown, and reaches the St. Lawrence in the neighbourhood of Brockville. The limestone deposit following the St. Lawrence down to St. Regis, has a wide spread of the sandstone coming from beneath it on the United States side of the river, the lower edge of which passes by Canton, Hopkin, and Malone, to Chateauguay, in a line north of east. Here it makes a sudden turn to the south-east, and the limestone sweeping round at its proportionate distance, comes upon the western shore of Lake Champlain at the mouth of the Chazy River, about five miles up which its base is seen. Running along the shore of the lake it reaches Peru, where the basset edges of both sedimentary deposits come close together. Following up the lake they attain Whitehall. They then bend round to the valley of the Mohawk, ascending which they arrive in the neighbourhood of Trenton, where a grand display of limestone in the Falls of that name gave origin to the New York designation of

the upper part of the deposit. From this the limestone gains the Black River, and follows down the whole of its course to Lake Ontario, of which it forms the coast from Ellisburgh to a point below Cape St. Vincent. Again entering Canada it composes Wolfe Island and the upper part of Howe Island, and it is seen resting on the primary rocks in Cedar Island without the interposition of the sandstone. Kingston stands upon the formation, and the base of it, cropping out several miles north of the town, strikes away to the Townships of Madoc and Marmora, in each of which the primary rocks are seen giving it support near their respective iron works. Thence it runs to Rama on Lake Simcoe, and sinks under the waters of Lake Huron in Georgian Bay. Between Kingston and Lake Huron the general dip of the formation is so small, that it is next to impracticable to measure it. The breadth of the band it presents is consequently considerable, thirty-five miles being the measure from its base at Marmora to its summit at Newcastle, on Lake Ontario. The north-eastern and northern shores of Lake Huron are described by Dr. Bigsby as presenting a primary country, and they may be taken as the boundary of the semidentary deposit we are following, from the point where it is lost beneath the waters of Georgian Bay, until it re-appears at St. Mary's Falls at the exit of Lake Superior, where the Michigan geologists describe a limestone apparently answering its conditions. Thence it reaches Green Bay, on Lake Michigan, and proceeds to the Wisconsin River, following it down to its junction with the Mississippi.

1. PRIMARY AND METAMORPHIC ROCKS.*

These rocks comprise the whole of the country to the north of Lake Simcoe, and the north-eastern shores of Lake Huron; and their character, in the localities visited by me, may be described as exactly similar in appearance to that of the masses which compose the "Thousand Islands," in the St. Lawrence below Kingston. The boundary between them and the lowest beds of the stratified limestone is distinctly seen at the head of a small sheet of water called St. John's Lake, in the township of Rama, within the distance of a mile from Lake Couchiching, and it is easily traceable from one lake to the other. The River Severn, which unites the waters of Lake Simcoe with those of Huron, passes its whole length over the primary rocks: and their junction with the fossilliferous sedimentary deposits may again be observed on the south shore of Matchadash Bay, and at the mouth of the Coldwater River. The line of junction, therefore, may be considered to run in a direction about W. N. W. and E. S. E., the whole of the township of Matchadash and the northern half of Orillia being on the primary.

Considering that my object, in the first instance, should be to determine the boundaries of the several formations as they might occur, with a view to entering into more minute details at a future period, I did not penetrate into the primary region in search of metals or minerals. The general character of the region, however, is such as would justify a careful and vigilant search for them when the general geology of the country is better known. Among these rocks I obtained some specimens of noble garnet; and a rich one of sulphuret of antimony, picked up among the drift on the shores of Lake Simcoe, was, in all probability, originally derived from them. Strong local attraction of the magnet, is said to have been observed in several places in the township of Matchadash, by Mr. Hamilton, the gentleman who made its survey, and it is probable that iron ore of the magnetic kind exists in it.

The rock masses observed in the primay district psrtake severally of the character of granite, syenite and gneiss, and on the banks of the Severn, at a spot between the Fourth Fall and Fifth or Great Falls, they seem to me to present evideneee of stratification. The strata there rise vertically from the edge of the stream to the height of fifty to sixty feet, and have all the appearance of coarse micaceous sandstone, which is in some places much contorted and frequently intersected by quartz veins. This exhibition of divisional planes, having all the regularity of bedding, induces me to consider that the term metamorphic, is one of appropiate application to some of the rocks beneath the fossilliferous, and unconformable with them.

In an agricultural point of view, the primary region on the banks of the Severn must be considered nearly valueless. With the exception of the accumulation of vegetable matter in the hollows where swamps exist, the country presents a surface of naked rocks, the only production of which is a dwarf pine—There is some good soft timber, however, in the swamps, and were the land capable of being drained, the swamps might be reclaimedand converted into meadows. But they are in general sonearly on a level with the river, that drainage would be impossible.

* From the Reports of A. MURRAY, Esq., Assistant Provincial Geologist.—Dated Woodstock, March 14, 1854.

Industrial Pathology; or the Accidents and Diseases incident to Industrial Occupations.

BY T. K. CHAMBERS, M.D.

I come to this room to-day for the purpose of introducing a subject, not indeed wholly new to the Society of Arts, but yet probably new to most of the present members. New, too, is the mode adopted of taking it up, namely, the appointment of a special committee, the undertaking of a special exhibition, and the issue of special circulars and reports upon it. I think, therefore, it cannot be devoid of use, and I hope not of interest either, to explain somewhat at length, *what Industrial Pathology is*, that is, what its aims are in the opinon of those who are taking a part in its promotion; *why the Society of Arts should concern themselves with it;* and *what the Council propose to do in the matter.*

Industrial Pathology then—(I do not particularly admire the name, but I did not make it)—Industrial Pathology is the "science of bodily SUFFERINGS connected with the carrying on of handicraft work."

Man's Creator ordained that he should eat bread in the "sweat of his brow," but he did not ordain that he should eat it in suffering, in the rotting of his vitals, the periling of his soul, and the welcoming of premature death. Though labour is the lot of our species, it is healthy, invigorating labour which is natural to them, and not that which entails misery and pain.

The highest and most natural state of man being the greatest perfection of body and soul, any occupation which tends to shorten his days, to make him a discomfort to himself and his neighbours, is unnatural, and a proof of barbarism and defective civilization. Every country where such occupations exist is lower than it might be in the social scale,—has not yet done its utmost to place man in his proper position as king of the world. As long as he that toils with the hands has a life shorter and more physically painful than he that toils with his brain, the duty of self-improvement is unperformed by a [illegible]

It is [illegible]

now in every known nation—that the corporeal labourers are both shorter lived and endure more physical evils than the mental labourers. Statisticians are explicit enough on that point. Now it will be found on enquiry that there are two distinct classes of evils to account for this. In the first class are included poverty, ignorance, political weakness, and other circumstances which prevent handicraftsmen surrounding themselves with the defences against pain and death placed in the power of their superiors. These causes it is the business of Political Economy, State Hygiene, and the science of Education to investigate and teach us how to remedy. But there is also a class of causes arising out of the nature of various descriptions of bodily exposure and exertion; pain, sickness and death accrue from some things necessarily part of the work, without doing which the man could not be industrious at his trade.—Here lies the field for Industrial Pathology. The first class of evils depend mainly on the work not being sufficiently regular or plentiful, or being under-paid, or some such economical mismanagement; the second is aggravated by abundance; the more a man has to do the worse he fares, and hence the propriety of the term "Industrial." I will illustrate this. There are two coal-whippers at the time of a commercial crisis in the coal-trade; fewer hands are wanted; one gets turned out of work, and the other is kept on. In six months time the one out of work is starving, because he was so weakened by temporary want of food that he was not fit for employment when he could get it. It is the business of the political economist to remedy commercial crises. The other man has worked as hard as possible in the way you know these fellows are engaged, jumping up a foot or two and throwing their whole weight on to a rope for ten or twelve hours a day; it is I believe the most wasteful, unscientific, and pernicious expenditure of human muscle that ever was devised. The consequence is that his heart cannot stand it, the fibres are overstrained with these continued violent jerks, and the organ becomes diseased. After a tedious illness, during which he is an incumbrance and expense to society, the industrious, well-paid man dies at forty.—Here it is that Industrial Pathology comes into play. It is the duty of that science to find out *why* such and such labour is injurious in a special manner, and to suggest a remedy. For example, in the instance quoted above, we may find out that it is the sudden jerk which is the cause of the injury to the circulation, and devise some better mechanism than is at present in use.

Again painters are liable to colic and palsy from the use of white lead; we may introduce a substance equally convenient in the shape of white zinc or other substitutes.

Tailors sit all day in a confined atmosphere, with the legs crossed and the spine bowed, so that neither the ribs nor the digestive organs have room to act. The consequence of course is that the stomach and bowels become disordered, the spine twisted, the gait shambling, and the power of taking the exercise necessary to health obliterated. If an artist wants to represent a starveling, he takes a tailor as his model; if a plump rosy man were to tell you he was a journeyman tailor, you would not allow such an evidently inexperienced workman to mend your coat. With a life embittered by indigestion, what wonder that a tailor takes to opium, gin, and tobacco, the only things that make existence endurable. Now cannot these evils be corrected? The cross-legged position is assumed because in the ordinary sitting posture the heavy cloth could not be held near enough to the eye. The problem is to invent some sort of table which would be equally convenient.

Shoe-makers and boot-makers suffer equally from a constrained position, and also from the pressure of the last against the stomach. Heartburn and painful digestion are so common, that a certain pill in the Pharmacopeia (the *Pilula Sagapeni Comp.*) is called the coblers' pill. A patient of mine, now in St. Mary's Hospital, has a hollow big enough to put one's fist in, from the pressure inwards of the breast bone by the boot-tree; of course his lungs and heart are diseased by such distortion. Cannot some one devise a new sort of boot-tree, which will not drive its tap roots into peoples lungs?

Looking-glass makers and water-gilders are constantly coming into hospitals for mercurial paralysis; and when they go out of the hospital they are not fit for much else than the workhouse. There are two ways of remedying this: one is to give them some protection against the poisonous fumes; and the other is to improve and cheapen rival modes of gilding and silvering, in which mercury is not used.

Washerwomen constantly suffer from varicose veins and other mechanical disorders arising from the standing posture. It is the business of Industrial Pathology to devise a chair in which they could work as at present, or else to discover some mode of doing the same thing by the agency of mechanics, which is now done immediately by the unaided body—to wear out mechanism instead of muscle, iron instead of energy.

I show you here a rotten jaw-bone, which Mr. Simon was obliged to cut out of a man's head because it was corroded by the noxious fumes evolved in the manufacture of lucifer matches. It is to be hoped that there is some mode of making them without rotting men's jaws, and this mode it is the business of Industrial Pathology to find out.

Few persons who walk much in the streets can avoid often meeting a bleeding groaning mass carried by on a stretcher, having just fallen from some ill-made scaffolding. It is the business of Industrial Pathology to enquire, whether it is an essential part of the nature of our countrymen to fall from scaffolding, or whether the construction of it might be so altered as to prevent the accidents. For the encouragement of those who are possessed with the latter idea, it may be cursorily mentioned that in China they have for several thousand years used a light bamboo scaffolding, covering the entire building like a network, and certainly preventing the falls which so often happen in Europe. Our ideas seem to have travelled wholly in the direction of making it stronger, heavier, and more unmanageable.

I trust that by these few familiar illustrations, I have made clear what Industrial Pathology is and how it differs from Hygiene. It does not profess to enquire into the health of the industrious classes generally, but only into their health so far as it is affected by their special occupations. It is desirable that this division of labour among scientific observers and teachers should be fully understood, in order that the facts collected should be properly arranged, and handed directly to those who will use them aright. Into the respective utility and consequent dignity of the two sciences I have not enquired: I only wish to point out which it is that the Council feel themselves called upon to take up.

I come now to the third question which may be asked concerning Industrial Pathology, viz., *how does the Council propose to be of use in this matter?* This has been in a great measure answered by a circular which has lately been issued, and which was printed in the Journal a few weeks ago. They propose in the first place to have an Exhibition of contrivance

and appliances for making the practice of handicrafts more healthy. What they expect to be sent to the Exhibition are, in short, means for working with less injury to the body than at present. Machinery of all sorts may appear, the express object of which is to guard against the myriads of accidents I spoke of, and save lives in numbers to be calculated statistically. Improved hand-tools will be a very valuable department; adzes which will not divide carpenters' shins, boot-trees which will not obliterate coblers' digestions, &c., may be shown to those most interested in using them. Safer ladders, scaffolding, chairs for window-cleaning, buckets for lowering men into wells, mines, &c., will save multitudes of industrious souls, if the invention of them can be stimulated. Another most important path of discovery is the inventing of substitutes for substances chemically noxious, such as lead, quicksilver, phosphorus, arsenic, the strong mineral acid sand alkalies; or modes of rendering their anxious qualities harmless, such, for instance, as fixing the putrid fumes of decaying matters preserved for manure or making leather. Another interesting department will be that of guards for the organs of sense of the individual workman—I mean such as will not interfere at all with present modes of manufacture, but will simply defend the artizan from the injuries it entails. As examples I have placed on the table a few articles referable to this class sent to us by Mr. Pillischer, of Bond-street. They consist of defences for the *eyes* against the effect of light, and mechanical injury; and if a third of the contrivances that are furnished to us are as simple and rational as these, we shall indeed be fortunate. Improved dresses for particular occupations may furnish another department.

Defences against injury by animals, such as safer harness, dog muzzles, &c., would prevent many an accident to a domestic servant and working man.

Such are a few examples of the sort of inventions which the Council trust will be sent for exhibition; and, considering the position we hold as the friend—equally and impartially—of master and workman; considering our standing with the public, and our widely extended connection with the manufacturing classes by means of the Institutes in Union, they have a right to expect many more than they themselves can name or suggest.

Thermography.

BY FELIX ABATE, OF NAPLES.*

This invention constitutes a new art, by means of which natural and artificial objects can be represented and imitated by printing directly from the objects themselves upon any suitable substance. The specimens submitted to the inspection of the Society at its last meeting, are imitations of veneering wood, some simple, and some ornamented with inlaid work, made upon wood, calico, and paper.

Before entering into the details of this invention, I may perhaps be allowed to state, in order to prevent mistakes, that it is essentially different from the well-known invention under the name of *Phytoglyphy*, or Nature printing, patented in England by Messrs. Bradbury and Evans, and practiced at the Imperial Printing Office at Vienna, and which consists in taking impressions in lead or other metals, or gutta-percha, from natural objects, making electro-plates from such impressions, and then printing with these plates in the usual way. The principle of my invention dates from an epoch anterior to the Great Exhibition of 1851, as I exhibited on that occasion the first specimens of a particular application of it, called *Metallography*. For this branch of the art I was rewarded with the Prize Medal. An idea of this art will be obtained from the following notice of the principles and processes upon which it rests:

The art of *Metallography* consists in printing from engraved wood blocks upon *metallic surfaces*, so as to produce imitations of figures and ornaments inlain in wood. This effect is obtained by using, as a printing menstruum to wet the block with, solutions of such metallic or earthy salts as are decomposed when brought into contact with certain metals, and produce, through an electro-chemical action, an adhesive precipitate of a coloured metallic oxide, or any other chemical change upon the metal. Such are the salts of copper, antimony, &c., upon zinc, tin, silver, &c.; the hydrosulphuret of ammonia upon copper and brass.

There are two principles at work in this branch of the art—the one is the chemical action just referred to; the other, which is the foundation and the key-stone of the invention, in its most general sense, rests in the porousness of the printing object, which causes the absorption of the wetting fluid, and yields it, under the action of pressure, in quantity for each point, proportionate to the capacity of the pores; so that if any chemical change is wrought upon the impression, to produce a colouring of it, this colouring, by its different shades, makes a true representation of the printing object.

The application of the invention to printing upon vegetable substances instead of metallic surfaces, required the introduction into the process of some new principle to produce that chemical change which, in metallography, is spontaneous. I devised, for that purpose, two principles, which, by different means, lead to the same results. One of these principles I borrowed from the art of dyeing. It consists in the peculiar actions that the salts, acids, and alkalies have upon each other, and upon vegetable colouring matters. It is upon these actions the processes of mordant and discharge printing on textile manufactures rest. The surface of the printing object is slightly wetted with the acting fluid, which is then well wiped off from the surface; the impression is then taken, which, by combining with a previous or a subsequent dyeing of the printed surface, instantaneously appears. The other principle I found in heat, that is, in the colouring action that this most powerful agent of Nature has upon vegetable substances when acted on by acids, which colouring I believe, is the effect of an accelerated carbonization of the surfaces of these substances produced by the acid. I think I may properly call this art THERMOGRAPHY, or the art of printing by heat.

From the following description of the process, it will be remarked—perhaps with some degree of surprise—the excessive sensitiveness of vegetable substances under the joint action of acids and heat, so that an infinitesimal dose of the former, and an instantaneous application of the latter, are sufficient to produce the most striking effects. The process is as follows:—

Suppose a sheet of veneering-wood be the object from which impressions are to be taken; I expose the wood for a few minutes to the cold evaporation of hydrochloric or sulphuric acid, or I slightly wet it with either of these acids diluted, and then well wipe the acid off from the surface. Afterwards it is laid upon a piece of calico, or paper, or common wood, and by a stroke of the press an impression is taken, which is, of course, quite invisible, but by exposing this impression, immediately

* Journal of the Society of Arts.

after, to the action of a strong heat, a most perfect and beautiful representation of the printing wood instantaneously appears. In the same way, with the same plate of wood, without any other acid preparation, a number of impressions, about twenty, or more, are taken; then, as the acid begins to be exhausted and the impressions faint, the acidification of the plate must be repeated as above, and so on progressively, as the wood is not in the least injured by the working of the process for any number of impressions. All these impressions show a general wood-like tint, most natural for the light-coloured woods, such as oak, walnut, maple &c.; but for other woods that have a peculiar colour, such as mahogany, rose-wood, &c., the impression must be taken, if a true imitation be required, on a stuff dyed of the light colour of the wood.

It must be here remarked, that the impressions as above made show an inversion of tints in reference to the original wood, so that the light are dark, and *vice versa*, which however does not interfere with the effect. The reason of it is, that all the varieties of tints which appear in the same wood are the effect of the varying closeness of its fibres in its different parts, so that where the fibres are close the colour is dark, and light where they are loose; but in the above process, as the absorption of the acid is greater in proportion to the looseness of its fibres, the effect must necessarily be the reverse of the above. However, when I wish to produce the true effect of the printing wood, I alter the process as follows:—I wet the surface upon which the impression is to be taken with dilute acid, and then I print with the veneering wood previously wetted with diluted liquid ammonia; it is evident that in this case the alkali neutralising the acid, the effect resulting from the subsequent action of heat will be a true representation of the printing surface.

Such is *Thermography*, or the art of printing by means of heat. Now it is nothing but natural to anticipate in regard to this art, as well as to the other above described processes for printing directly from objects, that they will afford most important services to the natural, botanical, mineralogical, and anatomical sciences; as it is by their means that the internal structure of bodies is unveiled to the eyes of the philosopher, and the wonders of nature in its inexhaustible varieties are indefinitely multiplied, to be subjected to the investigation and to serve the gratification of mankind.

But the new art will prove not less useful to the decorative arts, particularly in its application to produce imitations of rare and costly woods, as well as of works of art, mosaic and inlaid work, applicable for paper hangings, or for furniture in the place of veneering, these imitations being produced at an exceedingly low cost, while they rival in perfection the original objects enabling those whose means are limited to obtain decoration at once cheap and in good taste.

Materials for Paper Making.—Paper from Cow-dung.*

At the present moment, when we have every occasion to feel alarm at the serious position in which the manufacture of paper is placed, from the scarcity of the materials usually employed for making it, any suggestion, however simple, will not, I deem, be disregarded; especially when we consider how nearly this question is connected with the intellectual welfare of all classes. It is clear that should the present scarcity of rags continue, and no new substances be found applicable to supply their place, the publication of many useful periodicals must be discontinued, and the price of literature greatly enhanced.

Remembering the valuable paper printed in the Journal of the Society of Arts, about this period last year, upon the manufacture of paper from cow-dung, in which the author (Dr. Lloyd) stated he obtained a fibre from the dung of cattle, fed, or partially fed, upon flax-grass, I was induced to try a series of experiments, in order to ascertain whether the fibrous portions of common cow-dung, when the animals had been fed upon grass, hay, &c., were not applicable for the same purpose, believing that were a greater tenacity required than this article would afford, it could be more readily and more cheaply supplied by mixing with it a small portion of fibre from other substances, as from old nail-bags, &c., I am happy to report that these experiments have proved, to my mind, most successful, and that this mixture is well qualified for the manufacture of paper for printing purposes. I may also add that this opinion is confirmed by experienced paper-makers.

We have here, then, an almost inexhaustible source of material to supply the place of rags, and one which must necessarily increase with the increase of population. Nor would the use of this substance prove injurious to agriculture, as the fibrous portions of the manure are the least valuable for that purpose, and as the other portions could be returned to the land in the form best adapted to the requirements of plants.

It is not, however, in the present instance of so much importance to show from what substances paper can be made, as almost any fibrous substance is applicable for this purpose, as to point out one that will supply the place of rags, and at a much lower cost. This I believe would be the case with the substance in question, and by supplying a very simple machine to farmers, cow-keepers, and stable-keepers (for horse-dung may also be used), a very large amount of fibre might thus be obtained; it might also be collected from the fields, &c., when more of the soluble portions have sunk into the ground, leaving the fibrous portions upon the surface, affording employment to a class, unfortunately too frequently to be found, whose deficiencies of intellect unqualify them from following more profitable pursuits.

As the results of several experiments, I find that 1lb. of cow-dung yields about 1oz. of dried fibre, and this of course in a condition requiring a much smaller amount of mechanical labor to reduce it to the state of pulp than is the case with rags. Though I have made no very close calculations, I am induced to believe that it may be obtained at a very much lower price than that of rags at the present time. I have found no difficulty in bleaching it, and shall feel happy to forward samples of the unbleached and bleached fibre, also, if possible, of some paper made from it, in the course of a few days.

* By Alfred Coleman, Journal of the Society of Arts.

Political and Social Wealth.

The greatness, the wealth, and the comfort of the people of any country depend, as it appears to me, upon three main causes:—First, the natural advantages of the country; secondly, its acquired advantages; and thirdly, its social regulations. With regard to the natural advantages of this country, we have first our insulated situation, giving us for centuries past safety—giving us every advantage that can be had by our wide extended coasts for the commerce of the world—and giving us great and important natural advantages.

Secondly, we have a climate more equable, perhaps, than that of any other country in Europe, of which one of our monarchs remarked, that there are more hours in the day in which a man may enjoy himself out of doors in this country than in any other country in Europe. But is that all? It gives us a constant industry; it gives the means of working from early morn till night during the whole year. These are some of our natural advantages. It allows out-of-door work to go on continually. What have we besides? We have vast mineral wealth, greater than the gold of California or Australia—mines of iron and coal—short words, but having a wide and extended meaning. Iron means arms and ploughshares, tools and engines, bridges and aqueducts. It means those vast bridges that span the Menai Straits, one of which now stands the monument of the genius of one who is an ornament to this or any other country—I mean Mr. Stephenson—and it means, moreover, railways, which are now the highways for the whole world. These are some of our natural advantages. But have we not more? In that short word "coal," besides the fire which gives comfort in our dwelling, it is the foundation of our great hardware manufactures; it moves by steam all our factories; it gives employment to myriads of women and children—the tender sex and the tenderest age; it moves all our trains; it moves half our vessels. Coal and iron together mean a moving power equal to millions of pairs of hands, requiring neither clothing nor food to maintain them. The coal which is obtained in Great Britain alone amounts to thirty-seven millions of tons annually, whilst the produce of all Europe amounts to only seventeen millions of tons—not half what is raised in this island. Now what are our acquired advantages? They are still greater than our natural advantages. First of all, after a century of struggle, we get our religious freedom by the Reformation of 1530, and after a century of contest we had our civil freedom established by the Revolution of 1688. This country has afforded an asylum to foreigners from intolerance and bigotry in other countries, which has been repaid by a hundred inventions and discoveries. Our freedom was won, as Burke says, by our ancestors, owing to their spirit in the hour of contest, and their tenderness in the triumph of victory. Freedom is the mother of many blessings—of order and security, of industry, and enterprise, of wealth and plenty. Now, let us look for a moment at the effects of these natural and acquired advantages combined with the forty years' peace we have till recently enjoyed. Look at the changes they have produced, calling for corresponding alterations in the laws and corresponding facilities in our commercial transactions. But I have spoken of our social regulations as the third cause of the greatness, safety, and happiness of this country. What has the change been? First, in the population. In 1780 our rural population was to the civic population as 2 to 1; now the proportions are exactly reversed, and the population of our cities and towns employed in manufactures and commerce are as 2 to 1 of those employed in agriculture. From the census of 1801 you will find there has been a general increase of the population of 15 per cent—in the rural population of 10 per cent., and in our cities of 30 per cent.—that is, those who possess personal property in our cities have increased threefold as compared with the other portion of the population.—(*Jour. Society Arts.*)

On M. Marie-Davy's New Electro-Magnetic Engine.

BY M. BECQUEREL.

Attempts have been made for the last 20 years, to construct machines in which the magnetic property imparted to soft iron by the electric current should be employed as a motive power; but the electro-motive machines hitherto brought forward have been far from presenting any economical advantages over steam-engines.

Any electro-magnetic engine must be composed essentially of a series of electro-magnets of soft iron, of armatures also of soft iron, or arranged as electro-magnets, with various adjuncts, for the transmission of the electricity furnished by a battery or electro-magnetic machine, and of a commutator or breaker, for the purpose of producing a continuous circular or backward and forward motion.

In the machines hitherto constructed, these various parts do not combine all the conditions desirable for making use of all the power set in action; a cheap, constant, and powerful source of electricity does not yet exist; the soft iron, never being pure or perfectly malleable, retains for a longer or shorter period after each interruption a portion of the magnetization which had been communicated to it by the current; the primitive current and the extra current produce contrary effects, causing a mutual injury; and the commutators often present alterations when the circuit is closed.

M. Jacobi, moreover, who has carefully studied the subject of the practical employment of electro-magnetic engines, has arrived at this result—that the mechanical effect or amount of work, considering the expenses necessary to keep them in action, is far inferior to that of the other motive powers in use. But this does not set the question at rest; for if we succeed in discovering sources of electricity more economical and powerful than those at present in use, and in avoiding a portion of the inconveniences already mentioned, electricity and magnetism may take their place with heat as motive forces.

These considerations show that all researches having for their object the removal of some of the difficulties encountered in the employment of electricity as a motive power, should be received favourably; and the memoir recently presented by M. Marie Davy to the Academy contains some new views worthy of attention, as will be seen from the following report.

M. Marie thought, and with reason, that in order to obtain the maximum of effect in electro-magnetic engines, the electro-magnets and the armatures must act up to the point of contact, seeing that the electro-magnetic force, as he found by calculation and experiment, decreases so rapidly with the distance, that in employing two electro-magnets, when these are brought together from a distance to the point of contact, they develope an amount of work in such a manner that five-sixths are produced in the last millimetre, and the half of the remainder in the last but one; when the second electro-magnet is replaced by an armature of soft iron, three-fourths of the quantity of work are produced in the last millimetre through which the armature passes, and more than half the remainder in the last but one. In most of the rotatory electro-magnetic machines hitherto constructed, the moveable armatures pass rapidly before the fixed electro-magnets, following a line perpendicular to the axis, without coming into contact; thus the entire amount of work that might be obtained is not made use of. We must, however, refer to the fact that Mr. Froment, who has paid much attention to the electro-magnetic motor apparatus, has constructed a machine in which an interior wheel, furnished with armatures of soft iron, revolves upon the terminal faces of the fixed electro-magnets, so as to make use of the magnetic attraction even up to the point of contact of the magnetized

surfaces; but this arrangement produces, during the action of the machine, a series of shocks or concussions, which are opposed to the construction of a powerful machine upon this model.

M. Marie makes the moveable electro-magnets or armatures revolve in such a manner as to approach the fixed electro-magnets in the direction of the axis up to the point of contact, without any shock. Upon this principle are constructed the two electro-motive machines described in his note, one of which has a continuous rotatory, the other an oscillatory motion. We shall only refer to the former apparatus, of which he has prepared a model, which has worked in our presence.

This machine consists of 63 electro-magnets, arranged at equal distances round a circle of wood, furnished internally with a circle of copper. All the electro-magnets have their axis directed towards the centre of the wheel, and their surface coincides with the concave surface of the copper circle.

In the interior of this large wheel there are two others, of which the radius is one-third of that of the former; these are also furnished with a circle of copper, and bear each 21 equidistant electro-magnets, of which the axis are directed towards the centre, and the polar surfaces coincide with the concave surface of the copper wheels; these little wheels can then revolve, without slipping, in the interior of the large wheel, and carry round by their movement the axle of the machine, which corresponds with the axis of the large wheel. The moveable electro-magnets come successively in contact with the fixed electro-magnets. The large and small wheels are furnished with teeth for the maintenance of the coincidence, when this is once established.

The machine is also provided with various pieces of apparatus for putting each of the electro-magnets successively in communication with the battery, and giving a different magnetization to the two electro-magnets at the moment when they act upon each other.

M. Marie has made a change which appears advantageous, by replacing the internal wheels by others, which, instead of bearing electro-magnets, are surrounded by a ring of soft iron, which forms the armature; the moveable portion is thus rendered lighter, and the teeth are rendered unnecessary. It is this modification of the machine that we have seen in action. The circular electro-magnets of Mr. Nickels will here find an interesting application; and, at our suggestion, M. Marie proposes to make some experiments with this addition, which will enable him to augment the power of the machine without increasing the expense.

The construction of the machine is somewhat affected by the inexperience of the maker, so that it required a battery of 24 Bunsen's elements to produce 1-23d horse power. But, according to M. Marie's calculations, one of the same energy, or perhaps even one of less intensity, would be sufficient, with a machine of large size, to produce 300 times the power, seeing that the friction would not increase in the same proportion as the force of the machine; the means of electrical communication not being changed, and the power produced by the attraction of the magnets being capable of multiplication in a great degree, by making use of electro-magnets formed of large cylinders of soft iron. The model was constructed with a view to show the relations between the effect calculated from the magnetic force developed in the electro-magnet, and the actual force produced. The proportion was as 4 to 3, which is already a very close approximation, considering the numerous imperfections resulting from the bad construction of the machine.—*Comptes Rendus.*

Photography.

WAX PAPER PROCESS.

At the last meeting of the Photographic Society, a paper was read by Mr. Townsend, giving the results of a series of experiments instituted by him in reference to the wax-paper process. One of the great objections hitherto made to this process has been its slowness, as compared with the original Calotype process, and its various modifications; and another that its preparation involved some complexity of manipulation. Mr. Townsend has simplified the process materially, having found that the use of the fluoride and cyanide of potassium, as directed by Le Gray, in no way adds to the efficiency of the process, either in accelerating or otherwise. The iodide and bromide of potassium with free iodine give a paper which produces rapid, sure and clean results. He discards whey, sugar of milk, grape sugar, &c., hitherto deemed essential, but which his experience shows to be unnecessary. He exhibited three negatives of the same view taken consecutively at eight o'clock in the morning, with the respective exposures of 30 seconds, 2½ minutes, and ten minutes, each of which was good and perfect. The formula he adopts is:—

Iodide of Potassium	600 grs.
Bromide of Potassium, from 150 to	250 ,,
Re-sublimed Iodine	6 ,,
Distilled Water	40 oz.

The waxed papers are wholly immersed in this solution, and left to soak at least two hours, and are then hung to dry in the usual way. The papers are made sensitive by wholly immersing them in aceto-nitrate of silver of the following proportions:—

Nitrate of Silver	30 grs.
Acetic Acid	30 minims.
Distilled Water	1 oz.

the papers remaining in this solution not less than eight minutes. They are washed in two waters for eight minutes each, and then blotted off in the ordinary manner. Mr. Townsend states that there is no need to fear leaving the paper in the sensitive bath too long. He has left it in the bath 14 hours without any injury. The paper thus prepared will keep ten or twelve days; it may be longer, but his experience does not extend beyond that time. With paper thus prepared a portrait was exhibited, taken in 55 seconds, in a room with a side light, but it must be added that in this instance the paper was not washed, but was blotted off immediately on its leaving the sensitive bath, though not used until two hours had elapsed.—Mr. Townsend used for developing a saturated solution of gallic acid with a dram of aceto-nitrate to every four ounces of it, but he considers that this proportion of aceto-nitrate may be beneficially lessened. He finds that by this process he is certain of success, and is never troubled with that browning over of the paper which so often attends the use of the other methods of preparation. Besides the rapidity of action which he states, there is the further advantage that a lengthened exposure is not injurious. The proportion of bromide may vary from 150 grs. to 250; less than 150 is not sufficient to produce a maximum of rapidity, whilst more than 250 adds nothing to the effect.

Summary of a Report by Sir Charles Lyell,

*On the Industrial Exhibition at New York.—Geological Section.**

The mining products which formed the most prominent features of that department of the Exhibition, consisted of the different varieties of coal and metallic substances. The coal and iron ore were derived chiefly from the Eastern or Alleghany coal field; the lead from limestone and other rocks of Silurian age, as well as from the metamorphic formations; the zinc from the rocks of the latter character in New Jersey; and the copper from the similar regions in the eastern part of the States, but chiefly from the sandstone and trap district of Lake Superior. In the existing condition of the States, mining operations are, according to the report, for the most part in their infancy, beyond mining operations in coal and iron ore; and, perhaps, copper and lead may be now added. The mining enterprises hitherto undertaken have been more the result of chance and speculation than of any systematic effort to develope the mineral resources of the country; it consequently happens that the districts in which metallic products of value may be looked for, are but little known beyond their general geological features, and a few attractive or accidentally discovered localities of mineral wealth. Sir Charles observes, that in considering the industrial resources of a country of such vast extent, and which is still in its infancy, a juster idea of its capabilities can be formed by studying its leading physical and geological features, than by examining collections of its minerals and rocks in any place of exhibition. Gold is found in the Eastern States, or those on the eastern side of the Appalachian chain, occurring in the alluvial and drift formations and derived from the destruction of certain auriferous metamorphic rocks. The gold bearing drift extends from the northern limits of the States, in Vermont and New Hampshire, along the Green Mountain range, through the south-eastern part of New York, over the eastern flank of the Appalachian chain, to Georgia and Alabama. Gold has been obtained from the drift, in considerable quantities, in Georgia, North and South Carolina, and Virginia, but it has not been wrought for gold further north within the limits of the States, although it has long attracted attention in the same direction in Canada, and a considerable quantity of gold has been obtained from washings on the Chaudiere River. In California, the gold-bearing alluvium is derived from rocks of similar character: these auriferous sands and gravels are very extensively distributed; and the collections in the Exhibition showed samples of gold from nearly 200 different washings or localities in California alone.

Magnetic iron sand is a very general accompaniment of the same drift in the vicinity of mountain ranges; it has not, however, been applied to economic uses. Bog iron ore is almost universal, though in quantities to be valuable only in comparatively few places. The carbonates and per-oxide of iron occur in the coal fields, which contain rich deposits of those ores. In Pennsylvania and Ohio, where they are wrought to a greater extent than elsewhere, the beds appear to be inexhaustible, and will supply, for an indefinite period, the requirements of advancing physical improvements and civilisation. In Tennessee, Alabama, and Western Virginia, the coal formation abounds in iron ores; in the western coal field there is far less iron manufactured than in the east. The geological survey of Illinois, now in progress, has already shown that this state is richly supplied with iron ore in the midst of its inexhaustible coal fields, although they are as yet but two furnaces in that state. The iron ores from the coal formation presented at the Exhibition, were principally from Pennsylvania. The red shale formation in that state has a thickness of 2949 feet at Pottsville, and extends in a broad belt along the eastern margin of the coal fields. The ores of the red shale are chiefly carbonates of iron, with variable proportions of silica, alumina, &c.; they yield from 60 to 80 per cent, of carbonate of iron, and some of them give peroxide of iron in about the same proportion. The collection exhibited from Pennsylvania comprised the ore and furnace products—viz., ore, coal, slag, pig-iron, as well as manufactured iron; ores from geological formations below the coal, and occuring in the midst of the coal fields, having been exhibited in company with the coals by which they were smelted.

It is well known that the Americans set a far higher value on anthracite than on bituminous coals, although the United States are rich in vast coal fields of both descriptions. The anthracite basins of Pennsylvania produce coal of that character of a superior quality, and from its accessibility, it furnishes a large portion of the fossil fuel now used in the towns and cities of the Atlantic coast. A specimen of anthracite coal, of enormous size, from the Mammoth vein, Wilkesbarre, Pennsylvania, was presented to the exhibition by the citizens of that town, showing a vertical section of the vein, being a shaft, 5 feet square at the base, 30 feet high, and weighing 60 tons. Several other large masses—one 10 feet long by 4 ft. wide, and 3½ ft. high—were exhibited, from the same locality, with specimens of the same bed from other places. Coals from the Carbondale and Pittstown Mine, a collection of about 60 varieties of anthracite from the Schylkill County, were also presented with specimens of bituminous coal from Pennsylvania, accompanying samples of iron ore, and likewise from Maryland, in large masses, showing the thickness of beds, 11 and 15 feet respectively. Some of the coal seams are underlaid with beds of fire-clay, of greater or less thickness; and in some parts there are extensive beds of fire-clay not directly associated with coal seams, but they are everywhere co-extensive with the great coal fields. The iron ores of the coal formation, with their accompanying mineral fuel, are distributed more or less abundantly over an area exceeding 160,000 square miles; we are, from this extent, enabled to form some faint conception of their vast amount, and of the important results of their influence on the future industrial interests and prospects of such a country as the United States.

Galena, and the carbonate, sulphate, and phosphate of lead, have been found, but their economic value has not been as yet fully tested; and the sulphuret of lead occurs in considerable quantities in some of the copper mines recently opened in Maryland. The lead-bearing rock, or "galena limestone," of Wisconsin, Northern Illinois, Iowa, and part of Missouri, is a lower Silurian limestone, which has yielded immense quantities of lead ore for many years past. The products of a lead mine now wrought in the Shawangunk Mountain, in Ulster County, are galena, copper pyrites, and a small quantity of blende; and this mine has yielded some remarkably large masses of galena, one of which weighed 16,000 pounds. Native silver occurs in Davidson County and other counties in North Carolina. The native copper contains a small amount of native silver; and recently a vein of silver has been wrought upon the north shore

* From the Mining Journal.

of Lake Superior, specimens of which were shown in the exhibition.

Veins or lodes of sulphuret or carbonate of copper occur in the lead region, particularly at Mineral Point, Wisconsin, where they were formerly worked, but proved unprofitable; and they have been likewise found in Missouri. Metallic copper occurs mainly in the trap rocks, and the copper ores, running through sandstone and conglomerate, are not worked. Sulphurets and carbonates of copper occur in the gold region of Virginia and North Carolina, and in the same formation in Maryland. Native copper in large quantities is obtained from the trap rocks of Lake Superior; and numerous mines have been opened on the south shore of that lake. The copper is met with in sheets of greater or less thickness, in vein cutting the trap range nearly at right angles, and associated with various vein stones. These sheets of copper vary in extent, weighing from a few pounds to 80 tons; while the produce of copper from the mines of Lake Superior during the past year will reach 4,000 or 5000 tons. A mass of native copper in the Exhibition from one of these mines, weighed 6300 pounds; it was cut from a mass weighing 40 tons, and the thickness between the two natural surfaces was more than two feet.

A vein or bed of sulphuret of zinc, within the State of New York, has been somewhat extensively wrought. Zinc blende often occurs with the lead ores, and the red oxide of zinc and franklinite are found in New Jersey. The red oxide is largely employed in the manufacture of the white oxide of zinc, and the mixture of this ore with the franklinite, ground in oil in its natural state, forms a brown paint much in use. The franklinite has been of late successfully employed in a process by which the ozide of zinc is obtained, and the iron reduced, both operations being accomplished by the same furnace. Tin ore (oxide of tin) has been found in New Hampshire, and it also, in small quantities, accompanies the gold in Virginia and North Carolina.

On some of the Crystalline Limestones of North America.

BY T. S. HUNT, OF THE GEOLOGICAL COMMISSION OF CANADA.*

The crystalline limestones of Canada, with those of New York and the New England States, may be divided into four classes, belonging to as many different geological periods. The first and most ancient occur in that system of rocks, named by Mr. Logan the Laurentian series, which extending from Labrador to Lake Huron, forms the northern boundary of the Silurian system of Canada and the United States. The lowest beds of the Silurian repose horizontally upon the disturbed strata of this oldest American system, a southern prolongation of which crosses the Ottawa near Bytown, and the St. Lawrence at the Thousand Isles, and spreading out, forms the mountainous region of northern New York. This series consists in large part of a gneiss, which is often garnetiferous; but beds of mica slate, quartz and garnet rock, hornblende slate and hornblendic gneiss are also met with, besides large masses of a coarsely crystalline, often porphyritic rock, consisting chiefly of a lime and soda feldspar, which is sometimes labradorite, and at others andesine, or some related species, and is generally associated with hypersthene. It often holds beds or masses of titaniferous iron ore, and from its extent, occupies a conspicuous place in the series. It is the *hypersthene rock* of McCulloch and Emmons.

With these, the limestones are interstratified, but their relations to the formation have not yet been fully made out. All of these rocks bear evidences in their structure, that they are of sedimentary origin, and are really stratified deposits, but their investigation is rendered difficult by the greatly disturbed state of the whole formation. Among these stratified rocks, there are however dykes, veins, and masses of trap, granite and syenite, often of considerable extent, which are undoubtedly intrusive. There are abundant evidences that the agencies which have given to the strata, their present crystalline condition, have been such as to render the limestone almost liquid, and to subject it at the same time to great pressure, so that in many cases it has flowed around and among the broken, and often distorted fragments of the accompanying silicious strata, as if it had been an injected hypogene rock.

The limestone strata are from two or three feet to several hundred feet in thickness, and often present a succession of thin beds, divided by feldspathic or silicious layers, the latter being sometimes a conglomerate of quartz pebbles and silicious sand; in one instance, similar pebbles are contained in a base of dolomite. Beds frequently occur in which the carbonate of lime has been mixed with silicious sand, in some cases yielding an arenaceous limestone, while in others, a chemical union has produced beds of tabular spar, often passing into pyroxene from an admixture of magnesia. These minerals sometimes form beds, in a nearly pure state, but in other cases they are intermixed with quartz, carbonate of lime, orthoclase, scapolite, sphene and other species.

The limestones are sometimes coarsely crystalline, at others finely granular or almost compact; their color is white passing into reddish, bluish, and grayish tints, which are often arranged in bands coincident with the stratification. Some of the dark grey bands, harder than the adjacent white limestone, were found by Mr. Murray to owe their color to very finely disseminated plumbago, and their hardness to intermingled grains of rounded silicious sand. The limestone is often magnesian, and the manner in which the beds of dolomite are interstratified with the pure limestone, is such as to lead us to suppose that some of the original sedimentary deposits contained the two carbonates, and that the dolomite is not the result of any subsequent process.

The principal mineral species found in these limestones are apatite, serpentine, phlogopite, scapolite, orthoclase, pyroxene, wollastonite, idocrase, garnet, brown tourmaline, chondrodite, spinel, corundum, zircon, sphene and graphite. All of these appear to belong to the stratification, and the chondrodite and graphite especially, are seen running in bands parallel to the bedding. Magnetic iron ore is sometimes found in beds interstratified with the limestone. The apatite which is in general sparingly distributed, is occasionally very abundant in imperfect crystals and irregular crystalline masses, giving to small beds of the limestone the aspect of a conglomerate. Some of the coarsely crystalline varieties of this limestone give a very fetid odor when bruised.

In some parts of this formation, in the rear of the bay of Quinté, the rocks are less altered than in most other places, and here the limestones, although more or less crystalline in texture, afford none of the fine crystalized species elsewhere met with. The foreign ingredients seem to be mechanically intermixed, giving an earthy appearance to the weathered surface of the rock, or are separated in the form of small grains of pyroxene, showing an imperfect metamorphism. For further descriptions of the rocks of this series, see the Reports of the Geological Survey of Canada, particularly that of Mr. Logan for 1846, and Mr. Murray's for 1853; also Dr. Emmons's Report on the Northern District of New York. In position and in lithological characters, the Laurentian series appears to correspond to the old gneiss formation of Lapland, Finland and Scandinavia.

In the second class we include the crystalline limestones of western New England, and their continuation in southeastern New York, and the adjacent parts of New Jersey and Pennsylvania. The limestones of the Champlain division of the Lower Silurian rocks which are found on the Yamaska River, enter Vermont near Misisquoi Bay, where they show a commencement of alteration. Farther south, they become the white granular marbles of western Vermont, and of Berkshire, Massachusetts, which according to Hall, still exhibit upon their weathered surfaces, the fossils of the Trenton limestone: thence passing southwest, they cross the Hudson near West Point, and appear in Orange and Rockland counties, New York, and in Sussex county New Jersey, in a highly altered condition, closely resembling the crystalline limestones of the Laurentian series, and containing in great abundance the same imbedded minerals. These limestones are some-

* An Abstract of a paper read before the American Association for the Advancement of Science, at Washington, April, 1854.

times dolomitic, and Hitchcock observes that in the granular marbles of Berkshire, pure and magnesian limestones occasionally form different layers in the same bed. (Geology of Massachusetts, p. 84.)

In Orange county, according to Mather, it is easy to trace the transition from the unaltered blue and gray fossiliferous limestones of the Champlain division, (including the Calciferous sandrock and the Trenton,) to the highly crystalline white limestone with its characteristic minerals. (See his Report on the Geology of the first district of New York, pp. 465 and 486.) This view is fully sustained by H. D. Rogers in his description of the limestones of Sussex Co., given in his final report on New Jersey, (cited by Mather, as above, p. 468 et seq.(Mather farther concludes very justly that all the limestones of Western Vermont, Massachusetts and Connecticut, and those between the latter state and the Hudson River, are in like manner altered Lower Silurian strata. (p. 464.) From the similarity of mineral characters, he moreover supposes that the crystalline limestones about Lake George are of the same age, and he extends this view to those of St. Lawrence County. Both of these however belong to the Laurentian series,- and are distinguished by their want of conformity with the Champlain division, and by their association with labradorite and hypersthene rocks which seem to be wanting in the altered Silurian strata. The slates of this division in Eastern Canada, generally contain some magnesia, with very little lime, and four or five per cent, of alkalies, chiefly potash;* hence the feldspar which has resulted from their metamorphosis is generally orthoclase, and they have yielded gneiss, and mica slate, which with quartz rock, and chloritic aud talcose slates, make up the Green Mountains.

In the upper part of the Champlain division, there are found some beds of a limestone, often conglomerate, which is generally magnesian and ferruginous, and often contains a great deal of silicious sand; and associated with it are beds of carbonate of magnesia without a trace of lime, though sometimes very silicious. These beds are interstratified with slates and sandstones, and in the metamorphic region are replaced by the serpentines, which are often intermixed or associated with limestones and dolomites, and, with their accompanying talcose slates, may be traced one hundred and thirty-five miles in Canada, and thence by Vermont, Massachusetts and Connecticut, through New York, New Jersey, Pennsylvannia and Maryland, southward. These rocks are everywhere marked by the occurrence of chromic iron ore, in masses running with the stratification, or in disseminated grains, in the serpentine, and sometimes in the dolomite; they are also the auriferous rocks of the great Appalachian chain. Gold, associated with talcose slates, serpentine, chromic and titaniferous iron ores, is traceable along their outcrop from Canada to Georgia. Gold-bearing veins have also been found in the slates which in Eastern Canada, from the base of the Upper Silurian. I remark that in a somewhat chloritic and very silicious magnesian limestone, which is associated at Granby with red and green slates and sandstones, a portion of oxyd of chromium was detected by analysis. I have also found titanium in some of the very ferruginous slates, which by their alteration become chloritic schists holding magnetic and specular iron, ilmenite and rutile.

Serpentine is found as an imbedded mineral in the Laurentian limestones, but the extensive deposits of serpentine rock, with its associated talcose slates and chromic iron, appear to be confined to the upper part of the altered Champlain division. The examinations of C. U. Shepard, and those subsequent of J. Lawrence Smith and G. J. Brush, have shown that many at least of the so-called serpentine rocks of northern New York, are hydrous silicates of alumina, iron, and potash, containing very little lime or magnesia; they are the dysyntribite of Shepard.

As the north-western limit of the metamorphic belt in Eastern Canada runs southwesterly into Vermont, the undulations of the strata, which are nearly N. and S., escape from it to the northward. Proceeding E. S. E. however, from the unaltered Trenton limestones of the Yamaska, we cross the overlying slates, sandstones, and dolomites, and entering the metamorphic region find the serpentines, talcose, chloritic and micaceous schist, with gneiss and quartzite, very much disturbed, and repeated by undulations. On reaching the valley of Lake Memphramagog, we come upon the third class of crystalline limestones, which are Upper Silurian. This limestone formation has a continuous outcrop from the Connecticut valley, by the lake just mentioned and the upper part of the St. Francis river, to the Chaudière, and is thence traceable by intervals as far as Gaspé, where it is clearly unconformable with the Lower Silurian. It holds the characteristic fossils of the Niagara group, but for some distance from the line of Vermont, is so much altered as to be white and crystalline, and to contain abundance of brownish mica, the fossils being often obliterated.— At Dudswell on the St. Francis, the beds of white granular marble show upon their weathered surfaces or in polished sections, the forms of encrinal discs and corals, among which the characteristic *Favosites gothlandica*, and various species of *Porites* and *Cyathophyllum*, have been identified. These fossils in a similar condition are also found at Georgeville on Lake Memphramagog. Following the section in a S. E. direction, to Canaan on the Connecticut river, we meet with calcareo-micaceous schists, which are gradually replaced by mica slates, with quartzose beds. Some of the fine dark-coloured mica-slates exhibit crystals of chiastolite, and others near Canaan, abound with black hornblende and small garnets. (For the details of this section see Mr. Logan's Report for 1847—48.)*

These Upper Silurian strata constitute the micaceo-calcareous rocks of Vermont, which Prof. Adams traced through the state, to Halifax on the border of Massachusetts, and they are continued in what Hitchcock has called the micaceous limestone of this state, which according to him pass by insensible degrees into mica slate. The limestones of Coleraine, Ashfield, Deerfield and Whately, Mass., belong to this formation and perhaps also the crystalline limestone which is found at Bernardston, with magnetic iron and quartz rock, and shows imperfect fossils upon its weathered surfaces. (Hitchcock's Geol. of Mass. p. 560.) The condition of these limestones resembles that of the granular marbles on the other side of the Green Mountains, and they nowhere exhibit that degree of alteration which distinguishes the latter farther south. The same calcareo-micaceous rocks are conspicuous in western Connecticut; but in the towns of Salisbury, Sharon, and Canaan the crystalline limestones, and in Litchfield and Winchester, the serpentines, of the Lower Silurian are met with, and these rocks appear again in the southwestern part of the state.

In the fourth class we include the crystalline limestone of Eastern Massachusetts, which occurs in a great number of places in the towns of Bolton, Boxborough, Chelmsford, Carlisle, Littleton, Acton, Natick, and Sherburne. It appears according to Hitchcock, in interrupted lenticular masses, lying in the gneissoid formation, or in the hornblendic slates, and occasionally presenting distinct marks of stratification. Still further east at Stoneham and Newbury, we find crystalline limestone, sometimes magnesian, in irregular masses, lying in a rock intermediate between syenite and hornblende state. Serpentine is found with that of Newbury; and at Lynnfield, a band of serpentine has been traced two or three miles N. E. and S. W. Dr. Hitchcock, to whose report on the Geology of Massachusetts we are indebted for the present details, says of this serpentine, "I am satisfied that it is embraced in the great gneiss formation, whose strata run from N. E. to S. W. across the state." p. 159. He further remarks of the syenite of Newbury and Stoneham, which includes the crystalline limestones, "I have every reason to believe that it is only a portion of a gneiss formation which has undergone fusion to a great degree; for portions of the rock still retain a slaty or stratified structure," and he conceives it probable that all the crystalline limestones of Massachusetts are of sedimentary origin; p. 586. It may be remarked that the irregular shape of these interstratified masses, is analagous to the interrupted stratification and lenticular beds, frequently met with in fossiliferous limestones.

The limestones of Bolton, Chelmsford and the adjoining towns are in general highly crystalline, and are remarkable for the variety of fine crystallized minerals which they contain. Among these are apatite, serpentine, amianthus, talc, scapolite, pyroxene, petalite, chondrodite, spinel, cinnamon-stone, sphene and allanite, which include the species characterizing the Laurentian and Lower Silurian metamorphic limestones. The limestone of these quarries evolves a very fetid odor when bruised. Chromic iron ore has never so far as I am aware, been observed with the serpentines of this region.

We have now to inquire as to the geological age of this great mass of crystalline rocks which is so conspicuous in Eastern New England. Mr. Logan has shown that the rocks of the Devonian System in Gaspé, assuming the Oriskany sandstone as its base, attain a thickness of more

* See my remarks On the Composition and Metamorphoses of some Sedimentary Rocks, L. E. and D. Philos. Magazine for April, 1854, p. 233.

* See also on the Geology of Canada, Silliman's Journal [2] vol. ix. p. 12, and xiv. p. 224.

than 7000 feet, and as they are still 2,500 feet thick in New York, and do not die away before reaching the Mississippi, it is to be expected "that they would follow the Upper Silurian zone in its southwestern course from the eastern extremity of Gaspé, and display a conspicuous figure either in a metamorphic or unaltered condition, between it and the carboniferous areas of Eastern America; to one of which New Brunswick belongs, while another is met with in the state of Rhode Island, and in a metamorphic condition in Massachusetts." (Report for 1848, p. 58.) The lower part of the Devonian, farther west, embraces beds of limestone, but in Gaspé the formation consists almost entirely of siliceous and argillaceous beds. In Mr. Logan's section of the whole 7000 feet on the Gulf of the St. Lawrence, he observed only one small bed of limestone, and a few thin bands of limestone conglomerate. When we consider the geographical position of the Upper Silurian rocks in the Connecticut valley on the one hand, and the coal field of southeastern Massachusetts on the other, we can scarcely doubt that the intermediate gneissoid, and hornblendic rocks with their accompanying limestones, are the Devonian strata in an altered condition. Prof. Agassiz from his own examination of the region, was led to a similar conclusion as to the age of the so-called syenites, and in August, 1850, presented to the American Association for the Advancement of Science at New Haven, a paper on the age of the Metamorphic rocks of Eastern Massachusetts, which has never I believe been published. The less altered limestones which, according to Dr. Hitchcock are found interstratified with red slates at Attleborough and Walpole, may correspond to those which with similar slate and sandstone, are met with at the base of the carboniferous formation in Canada on the Bay de Chaleurs, and in New Brunswick.

We have then distinguished four classes of crystalline limestones: first, those of the Laurentian series with their accompanying garnetiferous gneiss, labradorite and hypersthene rocks; secondly those of the Lower Silurian formation, with their attendant auriferous rocks, talcose slates and chromiferous serpentines; thirdly those of the Upper Silurian age, with their associated calcareo-micaceous schists; and fourthly, those which belong to the gneissoid rocks of eastern Massachusetts, and are probably of the Devonian period.

I have endeavoured in this paper to bring together the facts known with regard to the different crystalline limestones, and their associated strata in this portion of the continent, and to show how far these may serve as a guide in the geological investigation of the metamorphic rocks While the result confirms the observations of European Geologists that similar crystallized minerals may occur in the metamorphic limestones of very different geological epochs; it also shows that within certain limits, the mineral characters of the altered silicious strata, may serve as important guides to our investigation.

On the Position of Fire-Places.

By Dr. Neil Arnott, F.R.S.*

This is the fit place for remarking on the fashion lately introduced in this country of placing the fire-grates much lower down than formerly—in some cases, on the very hearth—the reasons usually assigned being that a lower fire burns better, or gives out more heat from the same quantity of fuel, than a higher; and, because lower and nearer the floor, that it must warm the carpet better, and so lessen the evil of cold feet. Now, both these suppositions are curious errors or delusions, having their origin, in popular misconceptions respecting heat, and particularly respecting the radiation of heat.

Radius is the Latin word for the spoke of a wheel, and anything which diverges or spreads around from a centre, in some degree like spokes, is said to radiate. Light and heat are of this nature; the portion of either which passes in a straght line from the centre is called a ray.

The simplest observation teaches all that a lamp placed in the middle of a room radiates its light nearly equally in all directions; and most persons are aware that if an opaque mirror be placed close to a lamp on one side, it not only intercepts all the rays that fall upon it—and that means nearly half of the light given out—but it returns or reflects these rays back in contrary corresponding directions, and nearly doubles the illumination in those directions.

Most persons also have observed that if a fire, or a red-hot mass of metal, be placed in free space, it radiates its heat as well as its light nearly equally in all directions; but many do not learn, by their unaided observation, that if a surface of any substance, like fire-brick, which strongly resists the passage of heat through it, be placed near a fire, it not only intercepts the heat-rays falling on it, but after absorbing them, and so becoming heated, often to redness, it then reflects and radiates back the greater part of the heat, almost as if it were additional hot fuel in the fire, and thereby nearly doubles the warmth felt in directions away from the surface,

Neither does common observation make persons aware of the truth that of the heat produced by combustion in a common fire, one part—being somewhat more than half—is diffused, like the light, by radiation, into the open space around, and the remainder is given, by contact and conduction, to the air which supports the combustion, and to the solid material of the fire-place; Thus, with a common open fire-place, it is the radiant heat almost alone which warms the room, the remainder either at once combining with the burned air or smoke, and passing up the chimney, or being given by the heated grate to pure air, which touches that, then passing into the chimney with the smoke.

And, lastly, many persons do not at first learn the truth, that the rays of heat passing through pure or transparent air do not at all warm that air, but warm only the solid or opaque bodies by which the rays are intercepted, and that thus the air of a room is warmed only at second-hand, by contact with the solid walls and furniture, which having intercepted the heat rays, have themselves first become heated. Yet most educated persons know similar facts, such as that the sunbeams, bringing both light and heat to the earth, as they descend to warm the hottest valleys or plains of the earth, pass through the upper strata of the atmosphere, which are always of a temperature much below freezing. This is proved by the fact that all lofty mountains, even under the equator, are capped with never-melting snows, and that the higher the peaks are—and, therefore, the nearer to the sun—the colder they are. Thus, also, all persons who have attended to the subject know that aeronauts, in their balloon-car, if they amount very high, would be frozen to death, but that they are protected by very warm clothing. Another fact of the same kind is, that a glass globe, filled with cold water, or even ice, may in the sun's ray be used as a burning-lens.

These explanations being premised, the two popular delusions respecting the low fires become at once apparent.

1st. The supposition that fuel burnt in a low fire gives out more heat, has arisen from the experimenter not reflecting that his hand held over the low fire feels not only the heat radiated from the fire itself, but also that reflected from the hearth close beneath it, which second portion, if the grate were high, would have room to spread or radiate downwards and outwards to the more distant floor or carpet, and to warm them.

2nd. The notion that the fire, because near the floor, must warm the carpet more, springs from what may be called an error in the logic of the reasoner, who is assuming that the hearth, floor, and carpet being parts of the same level, are in the same predicament—the truth being, however, that in such a case the hearth within the fender gets nearly all the downward rays, and the carpet almost none—as a candle held before a looking-glass at a moderate distance diffuses its heat pretty uniformly over the whole, but if moved close to one part of the glass it overheats and probably cracks that part, leaving the rest unaffected. A low fire on a heated hearth is to the general floor or carpet of a room nearly what the sun, at the moment of rising or setting, is to the surface of a field. The rays are nearly all shooting upwards from the surface, and the few which approach it slant obliquely along or nearly parallel to the surface, without touching, and therefore without warming it.

Striking proof of the facts here set forth is obtained by laying thermometers on the floors of a room with a low fire, and of a room with the fire, as usual of old at a height of about 15 or 16 inches above the hearth. An experiment, tried in two such rooms, in both of which thermometers on the pianofortes, four feet above the floor, stood at 62°, showed the carpet, not far from the hearth, to be at 56° with the low and at 73° with the high fire.

* The subject of this article was referred to by Dr. Arnott, during the reading of his paper on the Smoke-consuming Fire-grate, on the 10th of May last before the Society of Arts; and as it has been deemed important, he has been good enough to give his remarks in writing, which may be taken as forming part of his original paper.

As would be anticipated by a person understanding the subject aright, low fires make cold feet very common, unless to those who sit near the fire with their feet on the fender; but, deceived by their fallacious reasoning, the advocates are disposed to blame the state of their health or the weather at the cause, and they rejoice at having the low fire, which can quickly warm their feet when placed near it. A company of such persons seen sitting close around their fire with thankfulness for its warmth near their feet, might suggest the case of a party of good-natured people duped out of their property by a swindler, and afterwards gratefully accepting as charity from him a part of their own property.

Many persons have been prevented from detecting the truths connected with low fires by the fact, that where the chimney breast or opening is also made low, the mass or stratum of comparatively stagnant warm air in the room is deeper or descends lower than where the chimney opening is high, and the room thus arranged may be, except near the floor, warmer than before. But advantages from this arrangement is often missed by the chimney throat being left too wide, causing strong cold draughts below; and where there are many persons in the room, the possible good is more than counterbalanced by the ventilation above being rendered in proportion more faulty. In the new smokeless grate, there is the advantage of a low chimney opening, although with a high fire, and yet the ventilation is maintained perfect for any amount of crowd by the ventilating valve, placed near the ceiling of the room.

It may be observed here, that the smoke-consuming grate exhibited in the Hall of the Society of Arts is of small size, fitted for a room of moderate dimensions, and was originally intended to be placed for inspection on the table, merely to show the principle; but the Secretary, judging that it would be more interesting if seen in action, desired it, although so disproportionate, to be fixed for the time in the fire-place of the large Hall. That grate was constructed by Messrs. Bailey, of Holborn; but the deviser hopes, as the whole arrangement is so simple, that intelligent manufacturers everywhere will be able to make it perfectly. He deems himself bound to publish, soon, any further instruction with regard to it which further and more varied experience may suggest.—*Journal of the Society of Arts.*

On the Decomposition of Rocks, and the re-composition of their metallic constituents.

By John Calvert, Esq.

The large quantity of gold found in the detritus of Australia, California, and other acknowledged gold regions, has called forth much speculation from many scientific minds as to the origin of so much alluvial gold, when the source from which it appeared to emanate (viz., the quartz veins) have so generally failed to produce it on being entered into or worked below the surface, thereby causing so much disappointment to gold mining speculations, the promoters thinking they had only to rip open the goose to ensure to themselves a plentiful harvest of golden eggs. The delusions and failures of gold quartz companies are such acknowledged facts, that it will be unnecessary for me to enter upon that part of the subject here. The origin or development of gold may be thus classified,—viz.:

1. When precipitation takes place simultaneously with the intrusion and upheaval of the palæozoic formations.

2. An after-precipitation, through the electric and atmospheric decomposition of the various rocks and metalliferous formations.

But a small portion of the gold we use owes its origin to the first circumstances; and gold having a surface determination, it will always percipitate itself there, and therefore would long ago have been an extinct metal in inhabited countries, were it not for the fact of the after-precipitation and development which is always going on wherever the matrix containing it is thrown under circumstances sufficiently kind to render the decomposition of the matrix favourable to the re-composition of the gold it may contain.

By far the greater portion of the gold we obtain at the various diggings and mines owes its realisation and development to this after-precipitation. The vast granite ranges in Australia and other places, the flanks of which are so constantly undergoing decomposition, and keeping up the supply of detritus and sands in the river and creeks which flow from them, are not found to contain any gold at the head of the creek, or in the granite detritus, until it has been washed into hollows, and beds of creeks and rivers, in company with an accumulation of organic matter: then, with sufficient moisture, the battery-power is active enough to precipitate the gold in nodules of various sizes, just in the same way that flint forms in chalk, or iron in bogs. an atmospheric decomposition of granite, containing a very small quantity of any other metal, is not sufficient to develope the gold it contains; but in the case of many of the various metallic ores, when in their combination exists sufficient of the opposing metal to create a self-acting battery, they will, after being exposed to a succession of winters' rain and summers' heat, be decomposed, and the gold and other metals they contain will be found to have re-composed themselves in other chemical states. But in many cases of rapid decomposition the waste of such a tender electric metal as gold will be very great, and more especially when decomposed by heat.

Nature's workings are beautiful, but in many instances very slow. Now, with regard to the gold in England, I have shown in my book, by many facts of history and tradition, that large quantities have been obtained at various periods. The English gold-fields, therefore, cannot be put upon a par with the virgin ground of Australia and other places, where Nature has been undisturbed and quietly producing it for many centuries, perhaps ever since that continent existed; still there are a few patches of ground here which have escaped the craving thirst of the ancient gold-diggers, and may yet be worked in England with a profit. Of those few isolated veins and spots that contain sufficient precipitated gold to pay for working, but two or three have been discovered and made known, and none properly worked.

If we would work gold in England on a large scale, we must seek it in other forms than its precipitated or metallic state; or the alternative will be to vigilantly search for the comparatively small quantity precipitated, and having worked that, wait patiently for some centuries whilst Nature accumulates more. I have watched the decomposition of rocks in many countries, have studied this subject the greater part of my lifetime, and have long since fallen into all the blunders and errors that so singularly characterise the gold-seeker's career, and which seem to so engross the public mind at present.

Whilst on my geological researches in Australia, in 1846, I discovered a boulder of granite, partially embedded in rich black soil, at the side of a river; it seemed as though it had been undisturbed for many years; it was in a state of discomposition. On the under side it was almost decomposed, and tinged with the oxide of iron; I could pick that part to pieces with my fingers; there were visible nodules of gold in all that portion that yielded to my fingers; there was no gold visible in the upper portion. This was a problem set me by Nature, which I toiled for many weeks and months to solve; many were the experiments and methods I fruitlessly tried. I could decompose the upper portion of that block of granite, but the gold was wanting. After some time I travelled back to the spot from which I had obtained it, carefully watched the chemical and electric conditions under which it had there been acted upon. I returned, tried fresh experiments, and succeeded in decomposing a piece of the upper portion of the granite block: the only difference was, that the grains of gold I obtained were smaller than those formed by the natural process. Ever since that time I have been able to perform the same experiments successfully upon rocks and ores, providing they contained any.

Now, as the great and Almighty Providence has so generously seen fit to invest man with the power to assist and force so many of Nature's productions, may it not likewise be within his scope to forestall Nature's decomposition of the vast masses she so slowly attacks, and by artificial means to perform that in a week or a month which otherwise would take years or centuries?—*Mining Journal.*

Materials for Paper-making.*

The question is frequently asked, "Why do not the Americans collect their own rags?" I apprehend the answer to be twofold:—First, happily the sources of employment open are so numerous and profitable that most persons can earn more at some other occupation than collect-

* By Alfred Coleman.—Journal of the Society of Arts.

ing rags; secondly, the ability to read, and the power of purchasing newspapers, books, &c., are so universal, that the demand for paper is much greater than can be met by any possible internal supply of rags. I could wish the European nations were similarly situated, and should be willing to risk the probable effects on the price of paper.

From the best estimate I can form, I think we shall not err in setting down the cost at which manufacturers now produce the 177,633,009 lbs. weight of paper, which it may be assumed will be made this year, at £1,000,000 more than the same weight would have cost in 1852. In 1832 only 64,935,655 lbs. of paper were manufactured in Great Britain, so that in twenty years the manufacture has nearly trebled its production, in 1853 the quantity being 177,633,009 lbs.

If the manufacture should keep at its present point only, the high price of material is likely to be permanent, but as the demand for paper will probably go on increasing, it well becomes the Society of Arts to prospect, if I may use the expression, for raw materials for this commodity. That the supply of paper will ever fail I have no fear, inasmuch as nearly a century ago paper was experimentally made from upwards of thirty different materials, and more recently attempts have been made, not without some success, to manufacture it on a large scale from plantain fibre, peat, wood shavings, hop-bines, straw, &c. Some specimens made a year or two ago from plantain fibre, were undistinguishable from good printing paper made from rags; I am not aware of the cause of suspension of operations. Experiments are still going on, I believe under a recent patent for the manufacture of wood paper. A patent has also been recently taken out for the manufacture of paper from hop-bines. I fear the cost of reducing several of these substances to pulp will be found too great to allow of the preparation being remunerative, even at the present high price of rags.

According to the views propounded on Wednesday evening, Dr. Royle and the speakers generally seemed to regard the various fibres then described as sources of ample supply for the paper-makers. In quantity and quality I will not for a moment dispute the point, but, with every desire to see the price of paper materials low, and, in my opinion, it is second to "cheap bread" only in importance, I am certain we shall not accomplish the object by self-deception on any one important fact; and neither hopes, wishes nor experiments can overcome market price; and on this ground I venture to express my doubts of the present availableness of the substances so ably pleaded for by Dr. Royle.

I find on inquiry this day, that the present market price of Manilla hemp is from 70s. to 76s.; jute, 27s. to 32s.; per cwt.; for plantain fibre I could not obtain the quotation. Now the best white-English and foreign cotton and linen rags, suitable for making writing paper, do not range above 34s. per cwt., and these suggested raw fibres would require much more chemical treatment than the rags of the same price. The rags have been brought into a textile condition from original fibrous state at a certain cost, which has been defrayed by the use to which rags were applied whilst in the state of garments, &c.; if, therefore, the substances mentioned on Wednesday *could* be used in lieu of the best rags it would only be a case of substitution—no advantage in price would be gained. The greatest rise, be it observed, has occurred in the lower quality of paper materials, and it is additional supplies of this description which are needed. If these new fibres be introduced for this purpose the case is still worse, manufacturers would be using a 32s. article for the production of paper, the ordinary materials for which are now only 10s. per cwt. It is not the original cost of fibre merely which must be considered, but also waste in manufacture, chemical cost of power, wear and tear and replacement of machinery, wages, duty, and profit, truly a formidable list of obstacles to cheapness.

Having offered these remarks on the various propositions which have been brought forward for removing the difficulty, I may be allowed to direct attention to what I conceive to be the true source of relief. I had hoped to have celebrated the repeal of the duty long ere this, but under present circumstances this happy event must be considered as indefinitely postponed; the repeal, however, come when it may, will be equivalent to an average reduction in price of about 20 per cent. The repeal of the duty, although it would to a certain extent lower the actual price of paper would, I have no doubt, have a tendency to raise the price of materials by increasing the demand for the manufactured articles. I should not, however, trouble you with these remarks if I depended principally upon the repeal of the duty for a reduction in price, but I am of opinion that an unlimited supply of a cheap and a suitable material exists in our own country. I refer to straw. The sheet upon which I write is made entirely from straw, and leaves little to be desired for ordinary uses, and for many purposes it is preferable to paper made from rags. Moreover, less power is required to prepare the materials, the process being more chemical than mechanical, an important matter, when the high price of coals in some parts of the country is considered. Why, then, has this manufacture been comparatively neglected? Solely, I believe, from the circumstance that the large quantity of alkali required to prepare straw for pulp, by combining with its resinous and silicious matters, causes that article, the alkali, to become a more important element of cost in the manufacture than the straw itself. To reduce the cost by recovering a portion of the alkali, an expensive mode of evaporation has been hitherto adopted. It has long been my decided conviction that this alkaline solution could be used as the raw material of some other manufactures, such as soap making, or for common glass, probably both, thus saving, at any rate partly, the expense of evaporation; and the great point I wish to bring before the Society is the desirableness of ascertaining to what uses this residuum can be profitably applied. If the expense of evaporation could be saved, the manufacture of paper from straw would be rendered more profitable, and a large supply would be the result, the rag market particularly for the inferior description of goods suitable for the manufacture of printing paper, be kept low, and the desired object would be thus accomplished. The proprietors of the following straw-paper mills, I believe all at present in existence, would, I have no doubt, supply some of their "black liquor" to any soapmaker, glass manufacturer, or chemist who might be disposed to try experiments with it, viz:—Tovil Mills, Maidstone, Kent; Queniugton Mills, Fairford, Gloucestershire; Burnside Mills, Kendal, Westmorland; Golden Bridge Mills, near Dublin.

I understand Mr. Simson, of Maidstone, has patented some process connected with this subject, but with the particulars I am not acquainted.

Irish Peat Company.

At a meeting of the shareholders of the Irish Peat Company, (July 1, 1854,) the following report of Mr. Powell, the temporary manager was read:—

In compliance with your request, I forward a short report on the working of the factory at Kilberry, from the period that the furnaces were lighted up to the present period.

Turf Consumed.—The turf consumed in the furnaces since the 18th March, the day on which the furnaces were first lighted, up to this day, amounted to 19,674 wagon loads, such as are used in charging the furnaces. Six of these wagon loads average 1 ton, giving the total amount of turf consumed as 3279 tons.

Tar Produced.—The quantity of tar collected up to the present time amounts to a little more than 70 tons, in addition to which there is now in the various tanks about 10 tons not yet collected, giving a total of 80 tons, or, as near as possible, 2¾ per cent. on the amount of turf consumed.

Tar Distilled.—47,518 lbs. of tar have now been distilled, which has yielded 730 gallons of rough oil, and 21,950 lbs. of rough paraffine and oil mixed, the whole of which is in course of separation and purification.

Naphtha.—From the ammoniacal liquor has been distilled, up to the present time, 223 gallons of rough naphtha, averaging more than 45 degrees above proof, and which, when re-distilled, and reduced to 37½ degrees, the usual marketable strength, will yield more than the same amount of rectified spirit.

Sulphate of Ammonia—We have further obtained from the ammoniacal liquor distilled 1½ ton of sulphate of ammonia, fit for market, and about ½ ton more in course of draining and evaporation: 6000 gallons of ammoniacal liquor yield, on an average, 10 gallons of naphtha and 200 lbs. of sulphate of ammonia, and we have at present about 30,000 gallons not yet distilled. These are the simple statistical facts relative to the products obtained from the turf hitherto consumed, but I do not consider that they are a fair criterion of what we have a right to expect from the same amount of

turf consumed, when the factory is in regular work, for the following reasons :—In the first place, on the furnaces being lighted the expansion in them was very considerable, and for some weeks I believe that the greater proportion of the products escaped through the innumerable openings thus formed ; this evil gradually abated as the furnaces became vitrified : 4 or 5 tons of tar may be considered as having been lost on first starting by the coating which the various tubes through which it passes have taken up ; but a far greater source of loss in products than either of these has been caused by the constant necessity of blowing out the furnaces from the front, in order to keep the bottoms of the furnaces sufficiently heated to prevent the slag from choking them. The great cause of this having been so constantly requisite, has been the excessive irregularity of burning, consequent upon the inefficiency of the blowing machine.

Gas.—For the last week or ten days since the blowing machine has been put in somewhat more efficient condition, the amount of gas has been very satisfactory. We have frequently had more gas than we required, though only working with two cylinders. Previously to this, there has been generally a deficiency of gas, and we have not, therefore attempted as yet to make any charcoal.

Iron Ore.—A considerable quantity of iron ore, both clay-band, and brown hematite, is calcined, and ready for putting into the furnaces, as soon as we can again get them sufficiently hot for smelting. This, however, cannot be, until we have had the four cylinders of the blowing machine continuously at work for a considerable period.

Turf Cutting.—We have cut this season up to the present time about 10,000 tons—1100 of which is now clamped. The excessive quantity of rain for the last month has prevented a greater proportion from being clamped. We have still on hand from last year's cutting 1600 tons of turf. The difficulty in procuring labourers for turf cutting has been this year unparalleled throughout the country.

I have strictly confined myself in this report to plain statistical facts, for these are what all will look to ; but had the general meeting been a month later, I feel confident, provided no unforeseen accident should occur, that I should have been enabled to form statistics relative to the further purifying of the products, that would have been much more satisfactory to the meeting than those I am at present enabled to afford—I allude more especially to the amount of pure parafine, and also of valuable oil that we now expect to obtain from a given quantity of tar. I trust, however, that the unvarnished statements which I have now given will be satisfactory as far as they go.—[I. F. Powell.

Product of the Precious Metals throughout the World in 1853.

	GOLD.	SILVER.	TOTAL.
America.	$109,156,748	$29,897,456	$138,964,204
Europe.	22,138,914	8,648,937	30,787,851
Asia.	19,847,658	5,197,218	25,044,876
Africa, &c. &c. .	4,000,000	. . . . .	4,000,000
Australia.	96,000,000	. . . . .	96,000,000
Grand total. . .	$251,143,320	$43,653,611	$294,796,931

The following will exhibit the annual product at various periods prior to above :

1492.	$250,000	1800.	$52,529,867
1500.	3,000,000	1842.	69,987,681
1600.	11,000,000	1848.	86,661,060
1700.	23,000,000	1851.	180,173,873

The statistics lately collected by the Secretary of the Treasury (U. S.) present some interesting facts. According to the statement of Mr. Crawford, the amount of specie in the country in 1820 was only $37,000,000.

Product of the mines from that date to 1849.		$37,705,250
Import of specie from 1820 to 1849 amounted to.	$252,169,841	
Exported during the same time. . . .	180,462,406	
Leaving an excess of imports over exports of specie to 1849 of.		71,707,435
In the country on the 1st of January 1849.		$122,412,685
Supply from the mines from 1849 to 1854.		194,363,117
Imported in same time.		26,508,774
		$343,294,576
Exported from the country between January, 1849, and January, 1854.		112,695,574
Specie in the country, in January, 1854.		$230,589,502

—being one hundred and eight millions of dollars more in the country now than in 1849. But there are large amounts of money brought into the country that cannot appear in statistical tables. It is estimated that over $30,000,000 in coin have been brought in by immigrants since 1849. Of the two hundred and thirty millions in specie in the country now, a little less than sixty millions is in the banks ; a little more than twenty seven millions in the national treasury ; and the balance is in circulation, or hoarded up by private owners. The gold and silver in circulation is over one hundred and forty-three millions of dollars now, and the circulation of bank paper is over one hundred and ninety-four millions of dollars. Together they make over three hundred and thirty-eight million dollars as the active money of the country at the present time.

Results of some recent Investigations of M. Vicat,

Upon the Destructive Action which Sea Water exerts on the Silicates known in the Arts as Hydraulic Mortars, Cements, and Puozzolanas.

M. Vicat, to whom we are so much indebted for our knowledge of the preparation of cements, has recently presented to the French Academy of Sciences the following *resume* of the chief general results to which a very long course of experiments upon that very important subject, the durability of cements in marine construction, has led him :—

1. That the double hydrated silicates of lime and alumina just mentioned are very unstable compounds.

2. That pure water, when poured upon all of them in the state of as fine powder as can be produced by ordinary means, no matter what might be their age or hardness, will dissolve a portion of their lime, provided they have not been in any way, or at least a very slight degree, exposed to the action of carbonic acid.

3. That if, under the same circumstances, a very dilute solution of sulphate of magnesia or Epsom salt be substituted for the pure water, the greater part, and often the whole, of the lime existing as silicates passes into the condition of sulphate. If any carbonic acid had previously acted upon it, the carbonate of lime thus formed is not decomposed by the sulphate of magnesia.

4. That all puozzolanas, no matter what might be their ages, require for their complete saturation a very much smaller quantity of lime than is added in practice, especially when we take into account their very imperfect state of division from the rough way in which they are usually prepared.

5. That the affinity of carbonic acid for the lime in combination in these various silicates is so strong, that it is possible, with the aid of a little moisture, to completely neutralise it, wherever it can penetrate, and thus leave all the other constituents of the cement, whether in combination or not among themselves, as mere mixtures in the mass.

It follows, from these results, that sea-water will destroy every cement, mortar, or puozzalana, if it can penetrate into the mass immersed in it. As, however, certain of these compounds are perfectly durable when constantly immersed in sea-water, they cannot have been penetrated by it. Its penetration has been prevented by the surfaces, and the source of this inability to penetrate is chiefly caused by a superficial coating of carbonate of lime, which has formed either anteriorly or posteriorly to their immersion, and which in time augments in thickness. The effect of a kind of cementation produced by the decomposition of the sulphate of magnesia, of the sea-water, and the deposition of carbonate of magnesia in the superficial tissue of the mass, and the formation of incrustations and of submarine vegetation, contributes also to this impermeability. But all such superficial impermeable coatings are not attached with the same force to the mass which they envelope. The differences which have been observed in this respect depend in some cases upon the chemical constitution, and upon the peculiar cohesion of the silicates, and in others upon the submarine situation, relative to the action of the waves and the rolling or dashing of shingle upon them. Hence the differences which have been observed by engineers in the durability of concretes of which such silicates form the gangue.

M. Vicat is preparing a memoir, in which he will attempt to explain the nature of the chemical constitution of those silicates which are durable, compared with those which are not ; and which will show the preponderating influence of silica in such phenomena. He will also point out a simple and certain method of classifying all such compounds, as to their fitness or not for submarine constructions, and thus will assist in very much shortening the time necessary at present for testting them by exposure to the action of sea-water. From the great practical importance of the subject, and the attention at present directed to it, this memoir will be looked foward to with considerable interest.—*Comptes Rendus de l'Academie, No. 4. January*, 1854.

Gulf Stream Exploration.*

This great and singular peculiarity, embracing in its mighty sweep our entire Atlantic offshore vicinage, is so important to navigation and so essential a feature of our coast hydrography, both in its practical and scientific character, that its thorough exploration ought certainly to form an integral part of the Coast Survey, whence our offshore charts are all to be derived. A specific and complete delineation and theory of this unique oceanic movement can only be reached as a result of elaborate and continned observations on all its physical and phenominal elements. This giant problem is thrown down as a gage at our national door, and the honour code of philosophic chivalry bids us accept the challenge. With a clear perception of the requirements of this great research, Prof. Bache in 1845 organized and began the execution of a plan of operations, which provided for running a system of perpendicular sections across the axis of the stream from selected points of the coast and observing at frequent stations along these sections, the several elements required. Between 1845 and 1848, sections wore run from Montauk Point, Sandy Hook, Cape Henlopen, Cape Henry, and Capo Hatteras ; when from accidents and other hindrances, the work was intermitted until in 1853, when sections were run from Cape Hatteras, Cape Fear, Charleston, St. Simons, St. Augustine, and Cape Canaveral. The results for 1853 are given in a sketch of detailed sections, and a general delineation of the Gulf Stream in its several component bands or threads, as thus far determined, will be found among the sketches. Over six pages of the Report are devoted to a full exposition of the results already reached.

The element of temperature, superficial and at various depths, has been chiefly observed up to this time ; the instruments used being Six's registering thermometer for moderate depths and Saxton's metallic deep-sea thermometer, for the greater depths, a temperature sounding of 2160 fathoms having been made. One general result of the investigation is that "there are alternations of temperature across the Gulf Stream, cold water intruding and dividing the warm, making thus alternate streaks or streams of warm and cold water. In fact, the Gulf Stream is merely one of a number of bands of warm water separated by cold water." A "cold wall" limiting the Gulf Stream on the shore side, is clearly made out, as also its slight shoreward slope from tho warm water overlying the cold. A distinct current of underlying cold water from tho northern regions is found alike in the northern aud southern sections. "It can hardly be doubted that this cold water off our southern coast may bo rendered practically useful by the ingenuity of our countrymen. The bottom of the sea fourteen miles E. N. E. from Capo Florida, 450 fathoms in depth, was in June, 1853, at the temperature of 49° Fahrenheit, while the air was 81° Fahrenheit. A temperature of 38° (only six degrees above the freezing point of fresh water) was found at 1050 fathoms in depth about 80 miles east of Capo Canaveral. The mean temperature of the air at St. Augustine is 69°·9 Fahrenheit, and for tho three 57°·5. The importance of the facts abovo stated in referenco to the natural history of the ocean in these regions, is very great, but, of course, requires to be studied in connection with other physical data. It has also a bearing upon the important problems of the tides of the coast. This exploration of the Gulf Stream will be steadily prosecuted to its close, the different problems being taken up in turn or in conuexion as may be found practicable."

Tho most remarkable fact brought to light in relation to the Gulf Stream is probably that of tho existence of two submarine ranges of hills near its origin, which produced most marked effects on the distribution of its parts. The form of the Charleston and Canaveral sections," as shown in the diagram, shoals gradually from the shore to 53 and 36 miles respectively, then suddenly falling off to below the depth of 600 fathoms. On the Charleston section, 96 miles frem the coast is a range of hills steep on the land side and having a height of 1800 feet and a base of about eleven miles on the seaward side; a second range 136 miles from the coast, 1500 feet high, with a base of about seventeen miles, on the outer side. Beyond this there is a more gradual rise. On the Canaveral section the inner range is 68 miles from the coast. The effect of this form of the bottom in forcing up the deep cold water stratum is very marked, so that the deep isothermals of section, exhibited a general conformity to the bottom curve. It is undoubtedly due in a considerable degree to these submarine hill-ranges, and to their uplifting of the cold water, that the Gulf Stream is divided into several superficial bands, though to what exact extent and how far subject to variations remain to be studied. Horizontally, the conformity of the Gulf Stream to the coast line configuration is verified even in detail, and its modifications by the variation of steepness in the off-shore bottom slope, are strongly marked. With these results the names of Lieuts. Davis, George M. Bache, Richard Bache, S. P. Lee, Maffitt and Craven are conspicuously associated; George M. Bache being distinguished as a martyr to his zeal, in the very glow of talent, hope and success.

The results of the microscopic examinations of seventeen Gulf Stream bottoms made by Assist. L. F. Pourtales (Appendix No. 30), are of great interest. From these and many other investigations of bottoms, he has derived the generalization that the per-centage of shells, chiefly Foraminiferæ, progressively increases with the depth, and he remarks of a bottom from the depth of 1050 fathoms that it "is no longer sand containing Foraminiferæ, but Foraminiferæ containing little or no sand. The grains of sand have to be searched for carefully under the microscope to be noticed at all." It will be seen that this result coincides with Prof. Bailey's recent announcement, thus closely linking the Gulf Stream bottoms with those of the remoter parts of the Atlantic. Mr. Pourtales also somewhat examines the question whether these minute animals lived where they were found, or have been gradually washed down from the reefs. Though not decisive the evidence inclines him to the opinion that they lived where found. This is indicated by the fact that most of the individuals are found perfect, notwithstanding the extreme delicacy of the shells, and again by the delicate pink colour of the Globigerinæ, which could scarcely survive transportation. The fact of the occurrence of the same species off the New Jersey coast and off Cuba and other West India islands under very dissimilar circumstances of light and temperature is also indicative that they are actually drawn from their true habitat in these Gulf Stream soundings. Mr. Pourtales well remarks on the importance of "a knowledge of the habitation and distribution of the Foraminiferæ" to geologists, "since of all classes of the animal kingdom, none has contributed so large a share to the formation of rocks, at least in the cretaceous and tertiary formations."

*Extracts from a review of the Coast Survey Report for 1853 in Silliman's Journal for September.

Railroad Traffic in Great Britain and Ireland.

From the semi-annual returns of the British Board of Trade it appears that the number of passengers conveyed on railways in England and Wales, Scotland, and Ireland, during the half-year ended 31st Dec., 1853, was 57,206,344, of which 29,529,696, were parliamentary and third class; 20,634,682 second class; and 7,028,966 first class passenge s. The total receipts for passengers amounted to £4,821,686, of which the sum of £62,061 was for periodical tickets, £1,534,863 parliamentary and third class, £1,46,646 for second class, and £1.468,196 for the first class passengers. As compared with the corresponding period of 1832, the total increase in the number of passengers was 7,320.221, or 14.6 per cent., and in the receipts of £461 ,519, or 10.6 per cent.; of which increase the sum of £7,449 was the periodical tickets, £173,962 for parliamentary and third-class, £115,297 for second class, and £159,224 for first-class passengers.

The total receipts from general merchandise, cattle, minerals, horses, carriages, luggage, parcels and mails, amounted for the half-year ending 31st December, 1853, to £5,023,904, and for the corresponding period of 1852, to £4,154,836, showing an increase of £869,068, or 20.9 per cent.

The total receipts from all sources of traffic, amounted on 7,641 miles of railway in the United Kingdom to £9,844,690, and for the corresponding period of the year previous, on 7,336 miles of railway, to £8,

515,003, showing an increase in the mileage of 305 miles, or 4.16 per cent., and in the receipts of £1,329,687, or 15.61 per cent.

The total receipts on 5811 miles of railway in England and Wales for the half-year ending December, 1853, amounted to £8,402.214,and for the corresponding period of 1852, to £7,289·180, showing an increase of £1,113,035; on 996 miles in Scotland to £971,742, and for the corresponding period of 1852 on 978 miles to £854,867; showing an increase of 28 miles,in the receipts of £116,876; and on 834 miles in Ireland, the receipts amounted to £470,733, and for the corresponding period in 1852, on 708 miles to £370,956, showing an increase in the mileage of 126 miles, and in the receipts of £99,777.

It appears also from the returns, that the mileage run by the trains on 5,588 miles in England and Wales, was by 522,142 passenger trains, 15,249,202 miles; and by 263,380 goods trains, 13,386,966 miles; on 823 34 miles of railway in Scotland, the mileage run by 56,060 passenger trains, was 1,694,244 miles, and by 43,306 goods trains, 1,548, 253 miles; and on 826 1-2 miles of railway in Ireland ,the mileage run by 43,016 passenger trains was 1,321,296 miles, and by 5,614 goods trains, 333,751, miles. From this it would appear that the average distance run by trains conveying the passengers in England and Wales was 29·2 miles, in Scotland 25·3 miles, and in Ireland 30·7 miles. The average distance run by goods trains in England and Wales appears to be 50·8 miles, in Scotland 35·9 miles, and in Ireland 56·4 miles.

The receipts per mile per passenger train amounted in England and Wales to 5·32s., in Scotland to 4·79s., and in Ireland to 4·79s. The receipts per mile for goods trains amounted in England and Wales to 6·43s., in Scotland to 7·31s., and in Ireland to 9·24s. per mile per train.

Statistics of British America.

	TERRITORY.	POPULATION.	EXPORTS,1853	IMPORTS,1853	REVENUE.
	Square Miles.	Inhabitants.	£.	£	£.
Canada, ...	400,000	1,842,264	5,570,000	8,200,642	1,053,026
New Brunswick, ...	28,000	200,000	796,335	1,110,600	180,000
Nova Scotia,	19,000	300,000	970,780	1,194,175*	125,000
Prince Ed. Island, .	2,000	75,000	242,675	298,543	35,345
Newfoundland, ...	37,000	100,000	965,772	795,737*	84,323
Total, ...	486,000	2.517,264	£8.545.562	£11.499697	£1,476.694

* 1852.

Toronto Harbour.

We understand it is the intention of the Harbour Commissioners to strengthen the peninsular boundary of the Bay at the narrows near the Hotel. Although the breach through which the water of the Lake flowed with a considerable current during the autumn of last year has been closed so effectually that it is now difficult to discover traces of its former existence, yet the present beach affords very doubtful security against future inroads. The narrowest part of the sand beach which occupies the late opening is about seventy-four yards broad, and nowhere exposes an altitude exceeding three feet above the present level of the waters of the Lake. There can be no doubt that stability is not a property of the sand beach at the narrows, nor is it probable that a firm barrier will be made until the waters of the Lake have assumed their minimum level, which they exceed at the present moment by more than two feet, that is to say the level of Lake Ontario is now about 2 feet 3 inches above the minimum level on the 25th Oct. 1849, or 2 feet 5 inches below the maximum level of June 1st., 1853. The Harbour Commissioners do not contemplate constructing any extensive works at the narrows; we believe that they will at present confine their operations to throwing up a sand beach a few yards broad and a few feet high. The effect of throwing up this artificial barrier will be to assist and expedite the natural process by which the integrity of the peninsula has hitherto been maintained, We forbear offering any opinions on the subject of Toronto Harbour at present, in consequence of the approaching publication of the Premium Reports on its Improvement and Preservation. The Harbour Commissioners have made a very liberal appropriation of funds for the publication of the Reports in the *Canadian Journal*, and we hope to furnish our readers with a supplementary number containing these documents in October.

The Provincial Show.

This great Agricultural Exhibition will be held at London, on the 26th, 27th, 28th, and 29th September. The most sanguine expectations are entertained of its success. Every facility has been offered by public bodies to increase the attractions which enliven, and remove the restrictions which impair, the progress of this great national Festival. The Great Western Railway Company will forward all articles of exhibition from Hamilton to London free of charge.

Changes in the Level of the Lakes.

Considerable anxiety exists among mercantile men at Buffalo, respecting the supply of Water to the Erie Canal. Grave doubts are felt whether the present feeders have the capacity to afford the necessary supply during a period of low water in Lake Erie. A memorial on this subject has recently been addressed to the Legislature of the State of New York, in which several ominous facts are pointed out. It appears that if Lake Erie should subside to the minimum level of 1820, which year was taken as the zero of comparison by Dr. Houghton and other geologists, the depth of water on the mitre sill at Black Rock Guardlock, would be less than five feet, through which all the water for the supply of a canal 150 miles long would have to flow. The average depth of water on the sill is about eight feet. In an elaborate paper on the periodical rise and fall of the Lakes, by Major Lachlan, Montreal, published in the July number of this Journal, we find the subjoined notices of the minimum and maximum periods of level in Lake Erie;—

MINIMUM PERIODS.			MAXIMUM PERIODS.		
1st	Min.	1795	1st	Max.	1790
2nd	,,	1810	2nd	,,	1801
3rd	,,	1820 zero.	3rd	,,	1815
4th	,,	1832	4th	,,	1827
5th	,,	1846 (2 feet above 1820)	5th	,,	1838
6th	,,	——	6th	,,	1853 very high.

In July, 1840, nine feet ten inches of water were recorded on the mitre sill at Black Rock; whereas, during the present year, there has been a short period when a depth of only five feet ten inches was to be found—a difference of four feet, and sufficiently important to cause the grounding of boats in the gore through the mountain ridge at Lockport. The memorialists ask "how shall navigation proceed in this canal, when the Lake shall fall nine inches or a foot more, as it must, to attain the level of 1820." It appears, too, that the Welland Canal has suffered from the rapid falling of the waters of Lake Erie. If they should continue to subside, and thus impede the navigation of that noble link between Erie and Ontario, we fear the prospects of the "lateral cut" will diminish with the receding waters, and the attention of the Board of Works be drawn to the enlargement of feeders, rather than to additional drains.

The New York memorialists are filled with gloomy anticipations in consequence of Lake Erie's decline. "From the above state of facts, we are drawn to the conclusion that there is imminent danger that with our present canal, and the probable level of the lake, our navigation will be partially or wholly obstructed. That for this impending evil there is but one remedy, and that this remedy should be applied forthwith; it is the immediate enlargement of the canal from Black

Rock Dam to Lockport. Next year the canal in its best condition, will be thronged with the products of the boundless, enterprising west. A slight interruption would be mischief—a total one, destruction to interests too extensive and momentous to be perilled for an hour. The welfare of the city of New York, New England, this entire State, and the vast West; the prosperity of our own city, and the solvency of the Treasury of our State, the credit of its stock, its faith and honour, depend on enough being done and done in time to arrest a catastrophe, which we are forced, against our own hopes of prosperity, to admit is like to happen. The remedy is within reach, and there should be no hesitation in making the application."

It is an ill wind that blows nobody any good.—What, if a stoppage of the navigation of the Erie Canal should bring into unexpected activity the Grand Trunk, the Great Western and the Ontario, Simcoe, and Huron Railroads? What, if Hamilton, Collingwood Harbour, and Toronto, should share much of the carrying trade which has hitherto passed through Buffalo, and the vast granaries of the Great West disburden themselves through the natural outlet to that region, the valley of the St. Lawrence, until the gentle stimulus of "Free Navigation?"

Materials for Paper-making.

In our present number we publish two articles on "Materials for Paper-making." The growing importance of this subject is attracting general attention in the United Kingdom, and has already secured a small corner in the public mind, by the recent increase in price of many newspapers and periodicals, solely on account of the scarcity of materials for making paper.

As is always the case, whenever any undue pressure is felt among the great manufacturing interests, arising from any dearth in the supply of raw materials, numerous attempts are made to relieve the want by the introduction and adoption of new sources of supply or of appropriate substitutes. For centuries past, by far the greater part of the paper consumed has been made from rags. There is, however, every reason to believe that a considerable supply has been manufactured from other kinds of fibrous matter. The natives of China manufacture the greatest part of their paper from the inner bark of the bamboo and various other trees. No inconsiderable portion of their common wrapping paper is made from rice straw.

The best materials for this manufacture are unquestionably linen, cotton, and hempen rags. They are the best, because they are as yet the cheapest. It is, however, a question not yet solved, whether they are artistically best adapted for making paper. For many years paper has been made from hop-bines, wood-shavings, straw, plantain, the inner bark of trees, and even from cow-dung, as will be seen by reference to page 32 of this Journal. Among the list of patents recently published in the Canada *Gazette*, is one for the manufacture of paper from Cudweed or Everlasting. We have good reason to believe that the search for paper-making materials is very assiduously pursued in Canada West. We had recently an opportunity of examining a raw material from the banks of the St. Clair, which appeared, from its fibrous nature, to give fair promise of successful application. The new material can be obtained in vast quantities, and without much labour or expense. No paper has yet been made from it, but we understand, that Frederick Widder, Esq., Chief Commissioner of the Canada Company, has made arrangements for procuring a supply of the fibre, and placing it in the hands of competent persons to examine its fitness for the important manufacture it is desirable to promote.

We may here remind our readers that many varieties of fibre are found to be well adapted for the manufacture of paper, and, indeed superior to rags; but their commercial value for other purposes does not admit of their application, or the expense of preparing the pulp from them precludes their adoption. If we suppose that the question of fibre is satisfactorily answered, the next question involves the preparation of the pulp; at what price can the fibre be converted into pulp?

We are indebted to a friend for a suggestion which we hope will arrest the attention of those who have the opportunity and means to engage in this useful and highly interesting search after raw material for paper manufacture. Why not make paper from bass-wood logs? Every one is familiar with the fibrous character not only of the bark but of the body of the tree itself. Partially decayed bass-wood logs may be procured to any extent in our forests, and they furnish a fibre of great tenacity, and comparative freedom from those impurities which it is necessary to abstract before a good sample of paper can be manufactured.

New York Industrial Exhibition.

We are indebted to the politeness of Mr. W. Antrobus Holwell, Commissioner from Canada to the Exhibition at New York, for the Special Report of Mr. Dilke, which was presented to the House of Commons by command of her Majesty, February 6, 1854. That portion of Mr. Dilke's Report which comprehends the Reports on Class 8 and 10, was written altogether by Mr. Holwell, and in our opinion constitutes by far the most important portion of the whole. The Report having arrived at the moment of our going to press, we are compelled to reserve farther notice until our next issue.

Miscellanea.

Theory of Glaciers—Shadow of the Moon—Weight of the Earth—Discovery of Iron-Stone in Ireland and England—Canadian Shipping—The Copyright—Distribution of Public Documents in the United States—Metallic Wealth of the United States.

Professor Forbes' work on "Norway and its Glaciers," completely established his theory of the growth and march of these stupendous moving masses of ice, as explained in his former works.

The leading facts on which that theory was then established are as follows:—1. That the downward motion of the ice from the mountains towards the valleys, is a continuous and regular motion, going on night and day without starts or stops. 2. That it occurs in winter as well as in summer, though less in amount. 3. That it varies at all times, with the temperature, being less in cold than in hot weather. 4. That rain and melted snow tend to accelerate the glacier motion. 5. That the *centre* of the glacier moves faster than the sides, as is the case in a river. 6. The *surface* of the glacier moves faster than the bottom, also as in a river. 7. That the glacier moves faster (*other things being supposed alike*) on steep inclinations. 8. The motion of a glacier is not prevented, nor its continuity hindered, by contractions of a rocky channel in which it moves, nor by the inequalities of its bed. 9. The crevasses are for the most part formed annually,—the old ones disappearing by the collapse of the ice during and after the hot season. The theory of motion, deduced from the facts above referred to, is thus given by Professor Forbes:—

"That a glacier is a plastic mass impelled by gravity, having tenacity sufficient to mould itself upon the obstacles which it encounters, and to permit one portion to slide past another without fracture, except when the forces are so violent as to produce discontinuity in the form of a crevasse, or more generally of a bruised condition of the mass so acted on;—that, in consequence, the motion of such a mass on a great scale resembles that of a river, allowance being made for almost incomparable greater viscosity,—hence the retardation of the sides and bottom. Finally, that diminution of temperature, diminishing the plasticity of the ice and also the hydrostatic pressure of the water which fills every pore in summer, retards its motion, whilst warmth and wet produce a contrary effect. These are the opinions which I laid down in 1842, and which ten years' experience and consideration have only tended to confirm."

The dark shadow of the Moon sweeping through the air during a

total eclipse, was seen this year by Professor Forbes in Norway. He says that the approach of the eclipse had been denoted by the appearance of a great black cloud in the north-west, which gradually rose above the horizon like an approaching storm; but its boundary (for it was merely the shadow in the sky) was too vague to produce the appalling sense of the onward movement of a real substance, with a speed exceeding about one hundred fold that of the most rapid railway train, and making right for the spectator, as I had observed on the plains of Piedmont on occasion of the total eclipse of 1842. But the restoration of the light,—the new dawn, when the shadow of darkness had passed by,—was perhaps quite as grand.

Professor Airey, the Astronomer-Royal, has paid a visit to the colliery district of the Tyne, in pursuit of curious and important astronomical observations. For that purpose he was taken by Mr. J. Mather, a scientific gentleman belonging to South Shields, down Horton pit, the deepest in the Tyne, 1260 feet deep, to examine if it were possible to make arrangements in it for a series of delicate experiments and observations in reference to the pendulum, and the earth's action upon it there, simultaneously with similar ones on the surface, with a view to determine the weight of the earth and planets. Mr. Anderson, and the other proprietors and officers of this splendid mine, gave every facility to the Astronomer-Royal, and tendered not only the use of the mine, but their own personal services, for any future occasion. Everything at present looks encouraging for these important scientific experiments.

A valuable discovery has recently been made in Ireland. It is no less than the certain existence of very extensive deposits of ironstone on the estates of Lord Carew, at Dysart, in the Queen's County. This discovery is considered very important, as there is a great demand for ironstone now in England, to supply the furnaces. An extensive field of the same mineral has also been found at Rosedale, near Pickering, Yorkshire. Samples sent to Newcastle have been found to contain not less than 67 per cent. of pure iron.

We extract from the August number of the *Artizan* the following list of steam and sailing vessels, built or building on the Clyde, since March, 1853, for British American marine and lake service:—

STEAMERS.

DESCRIPTION.	TONS.	HORSE POWER.	OWNERS OR STATION.
Paddle,	600	200	Hon. J. Hamilton, Kingston, C.W.
Screw,	1900	400	Liverpool and Canada.
Screw,	1900	400	,, ,,
Paddle,	120	110	Canada.
Screw,	2300	450	Liverpool and Canada.

SAILING VESSELS.

DESCRIPTION.	TONS.	HORSE POWER.	OWNERS OR STATION.
....	150	......	Montreal.
....	800	......	Glasgow and Montreal.
....	800	......	Liverpool and Montreal.
....	363	......	Henderson & Fulton, Montreal.
....	780	......	Liverpool and Montreal.
....	850	......	Montreal Trade.
....	700	......	Montreal Trade.
....	800	......	Montreal Trade.

With reference to the question of Copyright, the Athenæum has a letter on the last decision of the House of Lords, from which we take the following:—

"This last reversal of judgment was made at one o'clock on Tuesday, in the House of Lords—a reversal which, among other things, in effect upsets all American copyrights, and before six o'clock that day the printers in London were engaged in reprinting cheap editions of American Works. Messrs. Low & Co., alarmed for their property in "Sunny Memoirs of Foreign Lands," rushed to their printers to order a cheap edition; they found them already engaged for another house! By aid, however, of Mr. Clowes, Mr. Low hopes to forestall the printers, and we cannot but hope that he will succeed, seeing that he had already embarked capital in the production of the work, in a belief that his property was protected by law. The mails will carry out bad news to America; between the authors of that country and the publishers here. Mr. Bentley, we believe, has just concluded a treaty with Mr. Prescott, the historian, for his "Phillip the Second," at a thousand pounds a volume. It is now waste paper. The American historian is now in the same position as regards England, as the English author is as regards America. Bancroft's volume, also, has just appeared in London, though it has not yet been announced by his American publishers. Whatever has been, or is to be, paid for, the English copyright will, of course, be lost to him or to his publishers. We can form no estimate of the number of American books copyrighted in England, but they must form no insignificant part of the book trade of Great Britain. The English sales have certainly been greatly relied upon by American writers, and this decision will cut off a very substantial portion of the income of several of the more eminent of them."

Silliman's journal for September contains an article on the Coast Survey Report for 1853, in which some curious facts respecting the distribution of public documents, are brought to light. Every one is aware that for many years a most wanton system has been pursued in the distribution of valuable scientific, historical and documentary works, published by the authority of Congress, and at the expense of Government. Unfortunately, the scientific value of materials published in the documentary series whether of Congress or of State legislatures, is very much impaired by the unsystematic and injudicious plan *of distribution* actually pursued. Men of science, to whom particular reports would be of direct practical use, are often entirely unable to procure copies of them, while many men of more political importance, but who will never even look into them, have these same reports profusely lavished upon th m. Valuable documents which are reported to applicants as all exhausted, do wholesale duty as wrapping paper for Washington grocers and market men, at a standard price of four cents a pound, maps and plates included. This subject of documentary distribution deserves the serious attention of Congress, and it would not seem a vain hope that some system could be devised which would be indefinitely superior to that now prevailing, as well in respect to securing rigid responsibility for documents as property, and in promoting the economy, order and convenience of their practical distribution, as in the more important point of securing something like fitness in sending special documents to their appropriate recipients. Distributing Owen's Geological Report to a dry goods importer and the Treasury report on commerce to a geologist, would seem too great an absurdity to exist if we did not know that hundreds of truly valuable volumes are annually thus wasted.

"The Metallic Wealth of the United States described and compared with that of other Countries," from the pen of S. D. Whitney, contains many valuable facts concerning the distribution of mineral wealth in the United States. The following note of the estimated amount and value of metals produced throughout the world in 1854, is taken from a review of Mr. Whitney's work in the September number of Silliman's Journal:—

"The metals selected are gold, silver, mercury, tin, copper, zinc, lead and iron. The aggregate of these are as follows:—

Gold.	Silver.	Mercury.	Tin.	Copper.	Zinc.	Lead.	Iron.
lbs. troy.	lbs. troy.	lbs. av.	tons.	tons.	tons.	tons.	tons.
481,950	2,965,200	4,200,000	13,660	56,900	60,550	133,000	5,817,000

The product of the United States in gold is set down at 200,000 pounds, Australia and Oceanica at 150,000, and Russia at 60,000, Mexico and South America 47,100. Of silver, the New World supplies 2,473,700 pounds, leaving only the small residue of 491,500 lbs. for all other countries. Of mercury, Spain gives the world 2,500,000 lbs. and the United States 100,000 lbs. England and Australia furnish over half of all the copper produced by the world: the present product of the United States being in this metal only 3,500 tons. Prussia and Belgium furnish four-fifths of all the zinc used in the world (viz. 16,000 + 33,600 tons.) Lead is distributed between Great Britain, Spain and the United States in the ratio of 4, 2, 1 (viz. 61,000, 30,000 and 15,000 tons each.) England furnishes more than half the Iron of the world, 3,000,000 tons, and the United States 1.000,000 tons. France is the next most productive country in iron, 600,000 tons. Russia produces but 200,000 tons, and Sweden 150,000 tons, quantities bearing a very small relation to the celebrity of product of those countries.

STANNO-PLUMBATED IRON.—Several important experiments on the preservation of iron from oxidation and decay having been made by the Rev. N. Callan, of Maynooth college, who has introduced many im-

provements in practical science, he has found that an alloy of tin and lead, or of tin, lead, zinc, and antimony, is the most effectual. He recommends that all the alloy should contain at least as much lead as tin, but not more than 7 or 8 parts of lead to one of tin, the iron being treated with this composition just as it is usually coated with tin. In a series of experiments on the decomposition of water by the galvanic battery, the patentee found that concentrated nitric acid acted far more powerfully on lead than on iron coated with an alloy of lead and tin. He afterwards made experiments, comparing the action of strong nitric, sulphuric, and muriatic acids, on lead and galvanised iron, and iron coated with the new alloy, and found that the latter was far less oxidisable than lead, and very far less than iron galvanised, the zinc coating of which is rapidly dissolved, even by very dilute acids; hence, iron coated with this alloy will answer all the purposes for which sheet lead, lead pipes, or zinced iron are employed. The addition of a small portion of zinc hardens the coat, but diminishes the power to resist corrosion; while a little antimony hardens it, and increases its anti-corrosive powers. Stanno-plumbated iron will answer better for wire-rope than iron coated with zinc, as it will resist the action of sea-water better. It is preferable to lead, as cheaper, more durable, and less subject to changes from variations of temperature; and it may be used for all the purposes for which galvanised iron is employed; it is more easily worked and soldered. It may be used instead of copper for sheathing ships, and bolts and nails of cast-iron may be employed. As the proportion of tin need not be more than the seventh or eighth of lead, the alloy will be very little dearer than zinc, and from the greater durability, stanno-plumbated iron must be quite as economical as galvanised iron.

The Great Subterranean Railway.—The preamble of the North Metropolitan Railway has been declared proved by a committee of the House of Commons. The promoters had a hard battle to fight, and which lasted 11 days, but they triumphed in the end. This interesting and novel undertaking will commence at the General Post Office, in St. Martin's-le-Grand, and proceed beneath the streets and roads of the metropolis all the way to the terminus of the Great Western Railway at Paddington. The entire distance will be 4½ miles. It will cross Smithfield, and proceed along Fleet Valley to the New-road, taking Coldbath-fields Prison in its way. For the removal of this building the promoters have made an arrangement with the Middlesex magistrates. The terms are, that the promoters of the railway, in return for the ground in Coldbath-fields, are to build a prison for the county of Middlesex, not less than six, and not more than nine miles from London—the building to contain accommodation for 1500 prisoners, with 50 acres of ground attached, so as that those of the prisoners who have not learned in-door trades may be made to perform rural labour, in accordance with the industrial principle on which the prison is conducted. Three miles of the North Metropolitan Railway will run underneath roads, or unoccupied property, which will considerably lessen the expenses incident to the construction of the line. The entire estimated cost is 1,000,000*l*. The Subterranean Railway will join the Great Northern, the London and North Western, and Great Western lines. The stations are to be at Victoria-street, Clerkenwell, King's-Cross, Euston-square, Hampstead-road, Osnaburg-street, Baker-street, Edgware-road, and opposite the Great Western Hotel, with a branch to the Great Western station. Trains will start every five minutes. The time required to perform the journey will be a quarter of an hour, and the fares for the whole-distance will be 2d. for the third-class, 4d. for the second class, and 6d. for the first-class carriages. The North Metropolitan Railway will, therefore, be a great accommodation to the people of London, and will doubtless have an immense traffic.—At a special meeting of proprietors, on Monday, the solicitor read the heads of a bill, for extending the authorized line to the Great Western Railway and to the General Post- office, when a resolution, approving the bill, was carried unanimously

Soapstone.—A new building material is coming into notice in New York which promises to supersede everything else. This is steatite or soapstone, either in its purest state or in combination with other rocks. Its common qualities are perfectly familiar. It is so soft that it can be cut with a chisel, planed, bored, sawed, or turned in a lathe. Yet it resists pressure very well indeed, particularly when mixed with the harder ingredients, such as hornblende or serpentine. In beauty it is often found equal to marble, with even a greater variety of appearance. It bears an excellent polish, and, if broken, can easily be mended, by using its own powder as cement, so nicely as to be detected only by a critical examination. A house of this material was built at Northampton in 1807, and it is said to be still standing fresh and clear, to all appearance as if it had encountered only the rain of our last watery spring. The stone may be heated to a white heat, and then gradually cooled, or plunged into cold water at the option of the experimenter—and in either case it does not shell off nor crumble. Wet granite, as we all saw at the burning of the Custom-house, positively exploded in the heat—the flutings of the pillars, for instance, leaping off 2 or 3 ft. If therefore, soapstone should be employed for flooring as well as for walls (and there is no reason against it), a perfectly fire-proof building would be the result. So, if the assertions of all the chemists turn out to be correct, we have at last found out the very perfection of building materials. But they are testing the matter in New York, and we shall soon hear.—*Portland* (U.S.) *Advertiser.*

The Precious Metals in England.—At a time when the extraction of gold in England occupies so much attention, the following account of the presence of silver in England may prove interesting. An immense silver mine was worked in the vicinity of Aberystwith, in the reign of Elizabeth, by which a company of Germans enriched themselves; after whom Sir Hugh Middleton accumulated 2000*l*. a month out of one silver mine at Bwlch-yr-Eskir, by which produce he was enabled to defray the expense of bringing the New River to London. After him, Mr. Bushill, a servant of Sir. Francis Beacon, gained from the same mine such immense profits, as to be able to present Charles I. with a regiment of horse, and to provide clothes for his whole army. Besides this he advanced, as a loan to his Majesty, no less a sum than 40,000*l*., equal to at least four times the amount of the present currency; and he also raised a regiment amongst his miners at his own charge.

Lumbering on the Line of the Grand Trunk Railway.—The railway to Montreal has turned the forests along its line into gold. One of the leading and one of the earliest objections urged against the plan of the railway from Portland to Montreal, was the character of the country through which it was to pass. "The howling wilderness," so graphically depicted in the speeches of the friends of some of the rival lines, has been found, but instead of proving any discouragement to its friends, turns out a noble business for the railway. A timber township furnishes more business for the road than three ordinary farming townships of equal extent under good cultivation

Substitute for Gutta Percha, &c.—M. Sorel, C.E., of Paris has patented some improved compositions to be employed as substitutes for caoutchouc, gutta percha, and certain fatty bodies. The principal bases of these compositions are the following substances:—Colophony or common resin, bitumen or natural pitch, or the pitch obtained from gas-works, fixed resin oils, gutta percha, hydrated lime, and water. The above substances are employed (by weight) in about the following proportions:—Colophony, 2; pitch or bitumen, 2; resin oil, 8; hydrated lime, 6; gutta percha, 12; water, 3; pipeclay or other like argillaceous earths, 10.

Remarkable Temperature at Toronto during July.

This month has been not only the hottest July, but absolutely the hottest month recorded. The mean temperature has been 72°·5, which is 3°3 above that for August, 1848, the next highest of the whole record. By an inspection of the additional column in the Comparative Table, it will be seen that this July is no less than 6°·3 above the mean July temperature; an enormous excess, rendered more remarkable by the fact, that hitherto July has been the month of the whole least liable to extreme variations. The column containing the variations of the several days from the normal temperature for each day shows, that only four days have been below the normal, all the rest being above. The 3rd day is nearly the hottest that has ever been recorded, having reached 81°·3 which is 16°·2 above the mean of that day, and only 0°·7 below July 12th, 1845 (while it is 2°.5 above July 12th, 1849, the two highest previously). Notwithstanding this excessive temperature, the amount of rain fallen is above the average, and the number of times that thunder or lightning have occurred is also considerable.

*** In the Register for June (see August Number), read Comparative Table for *June*, instead of May

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—July, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.
					°	°	°	°	°													
1	29·773	29·800	29.776	29·782	63·4	79·7	59.9	69.50	+ 4.73	0·412	0·490	0.363	0·440	·72	·51	·73	·64	N	S S E	Calm	2·91	...
2	·810	·717	—	—	65·5	81·1	—	—	—	·446	·821	—	—	73	79	—	—	N E	E b S	—	2·68	...
3	·648	·569	·491	·555	71·5	93·0	78.1	81.32	+16.17	·525	·767	·543	·650	71	51	58	63	Calm	S	S W	2·59	...
4	·477	·341	·466	·424	74·3	93·6	69.6	78.60	+13.30	·575	·759	·616	·635	69	50	88	68	Calm	S S W	Calm	4·27	0·895
5	·554	·575	·608	·583	62·8	79·3	65.8	69.55	+ 4.17	·430	·633	·498	·509	77	65	80	72	N b W	S b W	N b E	3·96	...
6	·694	·696	·697	·699	64·4	82·2	65.3	71.83	+ 6.23	·459	·710	·495	·554	78	66	82	73	Calm	S b E	Calm	1·88	...
7	·713	·655	·610	·657	66·1	81·1	70.6	73.00	+ 7.30	·544	·509	·553	·531	87	49	76	69	N b E	E b N	Calm	3·42	...
8	·593	·467	·525	·522	69·8	91·0	74.3	79.23	+13.45	·519	·867	·751	·738	73	61	92	76	Calm	S b W	W	6·03	0·350
9	·616	·658	—	—	64·2	70·0	—	—	—	·518	·396	—	—	88	55	—	—	N N W	N W b N	—	7·28	...
10	·744	·715	·675	·709	58·5	76·8	63.2	67.28	+ 1.20	·370	·389	·464	·420	77	43	82	66	N b W	S b W	S W	3·63	...
11	·674	·607	·659	·653	67·1	73·3	62.5	67.87	+ 1.68	·474	·531	·480	·478	73	66	87	72	Calm	S	N N W	4·13	0·075
12	·749	·792	·838	·803	58·2	71·6	58.1	62.40	— 3.90	·336	·327	·299	·318	71	43	64	59	W N W	N W b N	N N W	8·03	...
13	·881	·836	·763	·818	56·3	73·1	54.2	61.98	— 4.40	·324	·457	·329	·386	74	55	80	71	N E	E	Calm	4·84	...
14	·727	·671	·675	·690	65·8	83·3	67.6	72.15	+ 5.73	·490	·526	·433	·504	79	48	67	67	N	S E	N	2·98	...
15	·753	·735	·698	·726	65·3	82 9	66.8	72.13	+ 5.65	·475	·557	·464	·498	78	50	72	66	N b W	S b E	Calm	2·67	...
16	·714	·683	—	—	71·1	77·0	—	—	—	·530	·523	—	—	72	58	—	—	N N E	E	—	3·73	Inap.
17	·757	·737	·740	·744	72·9	89·1	74.7	79.42	+12.75	·571	·472	·488	·515	73	36	58	54	N	S	N N W	5·01	...
18	·785	·690	·591	·683	74·0	83·3	69.3	74.93	+ 8.25	·603	·626	·576	·581	74	56	83	70	Calm	E S E	Calm	2·59	...
19	·576	·558	·511	·547	70·9	73·6	68.2	72.83	+ 6.05	·598	·715	·614	·671	82	89	92	86	Calm	E b N	W N W	3·09	1·135
20	·542	·455	·550	·521	72·6	92·1	74.3	79.95	+13.18	·731	·796	·756	·738	95	54	93	78	Calm	S	Calm	3·26	0·640
21	·630	·635	·626	·626	71·8	81·7	71.2	75.23	+ 8.47	·655	·716	·596	·666	86	68	80	78	N b W	E b S	N E b N	5·05	...
22	·596	·571	·615	.588	69·6	84·1	69.3	75.22	+ 8.35	·559	·787	·630	·666	80	69	90	79	N N E	E b S	N N W	3·19	0·565
23	·681	·658	—	—	67·5	81·7	—	—	—	·517	·639	—	—	79	60	—	—	N N W	S b E	—	2·34	Inap.
24	·675	·633	.579	·628	71·1	84·0	68.4	75.45	+ 8.58	·594	·618	·548	·606	80	54	81	72	Calm	E	Calm	3·02	...
25	·484	·351	·339	·387	68·4	88·8	75.4	78·98	+12.02	·600	·738	·655	·676	89	56	77	71	N E	S b E	S S W	7·44	...
26	·438	·533	·682	·563	73·6	78·1	57.4	69.72	+ 2.75	·620	·413	·303	·451	77	44	66	63	S W b W	W	W N W	12·84	...
27	.853	·823	·799	·813	61·9	74·2	56.5	64.52	— 2.47	·395	·404	·312	·397	74	49	70	68	N W b W	S	Calm	4·31	...
28	.822	·725	·686	·741	65·0	81·7	68.6	71.70	+ 4.73	·509	·500	·599	·543	85	48	88	74	Calm	S E	W S W	2·83	0·395
29	·451	·443	·513	·469	65.7	84.0	71.4	73.32	+ 6.37	·567	·772	·552	·614	92	68	74	77	S b W	S	S W b W	8·39	...
30	·713	·747	—	—	66·1	76·6	—	—	—	·497	·601	—	—	79	68	—	—	W	S	—	2·75	0·6,5
31	.807	·712	·651	·715	63·5	72·7	63.8	65.98	— 0.97	·522	·611	·466	·518	91	79	81	83	Calm	E b S	Calm	1·06	0·0 5
M	29·669	29·628	29·629	29·6403	67.09	81.86	67.10	72.47	+ 6.22	0.518	0.603	0·515	0·550	79	56	78	71	3·21	7·19	2·83	4.26	4·805

Highest Barometer...... 29·885, at 8 a.m. on 13th } Monthly range:
Lowest Barometer....... 29·308, at 4 p.m. on 4th } 0·577 inches.

Highest registered temperature 98°·0, at p.m. on 19th } Monthly range:
Lowest registered temperature 42°·5, at a.m. on 12th } 55°·5.

Mean Maximum Thermometer............... 84°·79 } Mean daily range:
Mean Minimum Thermometer............... 58°·46 } 26°·33.

Greatest daily range.........44°·5, from p.m. of 4th to a.m. of 5th.
Warmest day....... 3rd. Mean temperature...... 81°·32 } Difference,
Coldest day......... 13th. Mean temperature...... 61°·98 } 19°·34.
Greatest intensity of Solar Radiation, 106°·4 on 3rd, p. m. } Range,
Lowest point of Terrestrial Radiation, 38°·2 on 12th, a.m. } 68°·2.

Aurora observed on 4 nights: viz. on 3rd, 10th, 22nd, and 24th.

Possible to see Aurora on 26 nights.
Impossible to see Aurora 5 nights.
Raining on 9 days. Raining 28·7 hours; depth, 4·805 inches.
Thunder Storms occurred on the 4th, 8th, 11th, 19th, 20th, 22nd, 29th, and 31st.
Sheet Lightning, not accompanied by thunder or rain, observed on the 14th, 15th, 16th, 18th, 21st and 25th.
Hailstones and irregular pieces of ice fell during the thunderstorm on the 4th, at 4.30 p.m.

		H. M.			
Heavy Rain	on the 4th, in	2.30	there fell 0.895	inches on the	surface.
	" 19th, "	8.30	" 1.135	"	"
	" 20th, "	0.20	" 0.640	"	"
	" 22nd, "	0.22	" 0.565	"	"

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
976·23	1040·80	1110·08	823·43

Mean direction of the Wind, W 32° S.
Mean velocity of the Wind, 4·26 miles per hour.
Maximum velocity, 26.4 miles per hour, from 10 to 11 a. m. on 26th.

Most windy day, the 26th; mean velocity, 12·84 miles per hour.
Least windy day, the 31st; mean velocity, 1·06 " "
The velocity of the wind from 4h. 35m. to 4h 41 p. m., during the thunder storm on the 4th, equalled 6.8 miles, being at the rate of 68.0 miles per hour, and on the 8th from 5h. 26m. to 5h. 43m. p. m. it attained the rate of 33.9 miles per hour.
10th. Beautiful band of Auroral light from 9.20 to 10.50 p. m., rising from W horizon, passing through β Leonis in the West, α Coronæ Borealis in zenith, and bounded on its northern edge towards the east by α Hercules. This band was very remarkable from its fixity of position.

Comparative Table for July.*

Year.	Temperature. Mean.	Dif. f'm Avr'ge.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Wind. Mean Vel'y.	
	°	°	°	°	°				
1840...	66·0	—0·2	79·4	48·2	31·2	6	5·270	...	
1841...	65·0	—1·2	86·3	43·2	43·1	10	8·150	0·27	lb.
1842...	64·7	—1·5	90·5	42·0	48·5	4	3·050	0·33	lb.
1843...	64·5	—1·7	86·1	40·2	45·9	8	4·605	0·44	lb.
1844...	66·0	—0·2	86·1	40·5	45·6	12	2·815	0·19	lb.
1845...	66·2	0·0	94·6	45·6	49·0	7	2·195	0·30	lb.
1846...	68·0	+1·8	94·0	44·9	49·1	9	2·895	0·29	lb.
1847...	68·0	+1·8	87·5	43·8	43·7	8	3·355	0·19	lb.
1848...	65·5	—0·7	82·7	46·7	36·0	10	1·890	4·94	Miles.
1849...	68·4	+2·2	89·1	51·0	38·1	4	3·415	3·52	Miles.
1850...	68·9	+2·7	84·9	52·8	32·1	12	5·270	4·56	Miles.
1851...	65·0	—1·2	82·7	52·1	30·6	12	3·625	4·13	Miles.
1852...	66·8	+0·6	90·1	49·5	40·6	8	4·025	3·33	Miles.
1853...	65·6	—0·6	85·4	49·4	36·0	10	0·915	3·70	Miles.
1854...	72·5	+6·3	93·6	53·0	40·6	9	4·805	4·26	Miles.
								0·29	lb.
M'n.	66·74		87·53	46·86	40·67	8.6	3·752	4·06	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—July, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—*118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	Inch.	6 A.M.	2 P.M.	10 P.M.
1	30.020	30.017	30.058	62.1	80.6	65.0	·379	·681	·483	·71	·68	·78	W N W	S W	S S E	2.36	3.40	1.22	...	Clear.	Clear.	Str. 1.
2	30.123	30.003	29.900	65.6	82.1	65.0	473	618	555	76	57	89	S W b S	S b E	S	Calm	2.56	0.75	...	Light Cirrs. 4.	Cir. Cum. Str. 6.	Clear.
3	29.810	29.762	29.754	68.6	85.6	78.2	523	763	776	76	65	82	S S W	W S W	S b W	0.16	1.56	6.25	...	Cir. Str. 3.	Str. 2.	Do. Aur. Bor.
4	.660	.552	.664	80.0	95.4	77.8	762	986	827	73	57	90	S S W	S S W	S S W	2.60	6.37	5.51	0.070	Clear.	Str. 8. Thunder	Str. 10.
5	.798	.814	.891	71.0	76.2	61.6	588	515	407	78	58	75	W b N	W b N	W b N	4.33	6.46	7.05	...	Do.	Clear. [& Light.	Do.2. Aur.Bor.
6	.933	.989	30.000	66.0	82.0	68.4	474	550	582	74	52	85	W b N	W b S	N W	Calm	1.26	2.01	...	Do.	Clear.	Do. 4.
7	30.070	30.007	29.979	69.5	89.1	70.0	570	681	541	81	51	74	N W	S W b W	S b W	Calm	Inap.	Calm	...	Do.	Do.	Clear.
8	29.897	29.800	.896	77.1	94.3	86.7	648	940	681	71	50	56	E	S	N E	Calm	0.62	6.66	...	Hazy.	Do.	Cum. Str. 2.
9	29.734	.912	.921	77.8	84.6	64.5	787	896	450	86	78	75	S b W	W b S	N	1.50	4.00	10.00	...	Cum. Str. 4.	Cum. Str. 8.	Do. 9.
10	30.026	.964	.955	66.2	89.0	64.0	425	888	476	71	44	79	N E b E	S b W	S W b S	Inap.	Inap.	0.38	...	Clear.	Clear.	Clear.
11	29.968	.924	.907	70.0	86.5	64.0	499	617	482	69	50	80	W b S	S S W	S W b S	0.51	0.50	Calm	...	Do.	Do.	Str. 2.
12	.947	30.001	30.055	66.2	83.1	57.1	464	588	335	72	53	70	W	W	N W b W	1.05	4.37	7.30	...	Str. 2.	Str. 4.	Clear Aur. Bor.
13	30.210	30.164	30.111	60.0	83.9	66.0	393	588	416	75	53	65	W N W	S S W	S b E	3.66	1.42	0.13	...	Clear.	Clear.	Do.
14	30.066	29.961	29.943	64.3	90.2	69.2	504	638	570	84	46	81	N E b E	S W b S	S b W	0.49	Calm	Calm	...	Do.	Do.	Do. Faint A. B.
15	29.990	29.986	30.011	63.6	91.3	71.3	565	814	617	94	59	82	N E b E	E N E	S W	6.34	0.92	0.82	...	Do.	Do.	Str. 2.
16	30.000	30.003	29.990	70.7	93.6	77.8	550	638	715	76	47	78	E b S	W	S W b S	Calm	0.92	2.12	...	Do.	Do.	Cir. Str. 9.
17	29.943	30.009	30.007	76.8	92.6	72.3	659	607	638	74	44	82	W b S	W b S	N W	2.13	4.27	8.70	...	Do.	Do.	Clear.
18	30.070	29.922	29.880	68.0	85.4	74.0	512	628	643	73	53	78	N W	W b N	W S W	1.25	1.47	0.83	...	Do.	Do.	Cir. Str. 2.
19	29.805	.740	.764	74.6	98.0	76.2	617	550	801	74	40	90	S W b W	W S W	W	1.92	2.00	7.66	...	Do.	Do.	Clear.
20	.787	.783	.754	80.1	98.0	74.1	751	578	751	75	42	84	S W b W	S S W	W b S	0.47	9.00	5.50	0.104	Do.	Do.	Do. Thunder at
21	.945	.973	30.018	72.6	85.1	66.0	578	840	489	74	71	76	N b E	N N E	N E b E	4.28	4.30	7.52	...	Do.	Do.	Do. [5.30
22	.974	.933	.913	70.0	84.0	73.9	541	739	751	74	64	90	N E	N E	E b N	7.00	1.02	2.00	...	Do.	Hazy.	Str. 10.
23	.943	.926	.960	74.1	80.7	72.0	681	910	670	82	75	86	W S W	W	W	1.62	2.60	0.48	Inap.	Str. 4. Slight	Cum. Str. 4.	Clear.
24	.985	.976	.994	75.0	94.2	72.0	670	814	704	78	59	90	S W b W	S W b W	S W b W	Inap.	Calm	1.32	...	Clear. [rain	Str. 2.	Str. 2
25	.905	.684	.673	76.2	90.1	80.1	692	814	827	78	59	82	S S E	S S E	S	Inap.	Calm	7.60	...	Do.	Cum. Str. 2.	Do. 4. Dist. th.
26	.665	.656	.800	76.0	91.0	70.6	628	739	568	71	53	78	S S W	W b S	W b N	8.75	9.50	8·77	Inap.	Cum. Str. 5.	Do. 5.	Str.2. Slight sh.
27	30.028	30.044	30.055	64.8	78.1	68.7	504	450	523	84	47	76	N W b N	N W b N	S W b W	3.38	4.25	Calm	...	Clear.	Do. 2.	Clear. Faint A.
28	30.103	30·019	29.982	66.7	87.1	71.0	506	638	617	76	51	82	W	S W b W	S W	2.13	3.84	1.00	...	Do.	Clear.	Cir. Str.8. [Bor.
29	29.823	29.645	.677	65.0	77.0	69.3	555	648	668	89	71	95	S W b S	S W	S W	0.99	4.25	7.00	Inap.	Slight Rain.	Do.	Clear Aur. Bor.
30	29.784	29.921	.992	65.5	84.4	61.5	527	814	483	85	71	89	W N W	W N W	W N W	4.21	3.21	8.14	...	Clear.	Clear.	Do.
31	30.082	30.021	.992	67.7	91.6	69.0	455	814	541	69	59	76	W N W	S W	S W	Inap.	Inap.	Calm	...	Do.	Do.	Do.

Barometer	Highest, the 13th day	30·210
	Lowest, the 29th day	29·645
	Monthly Mean	29·916
	" Range	·565
Thermometer.	Highest, the 20th day	100°·1
	Lowest, the 10th day	51°·6
	Monthly Mean	76°·2
	" Range	48°·5
	Mean Humidity	·709
Greatest Intensity of the Sun's Rays		141°·2

Rain fell on 5 days, amounting to 0·174 inches, and was accompanied by thunder and lightning on 2 days. Raining 1 hour, 50 minutes. Amount of evaporation, 5·12 in.

Most prevalent Wind, S W by W. Least prevalent Wind, N.

Most Windy Day, the 5th day; mean miles per hour, 5·91.

Least Windy Day, the 7th day; mean miles per hour, Inap.

Aurora Borealis visible on 7 nights. Might have been seen on 14 nights.

The electrical state of the atmosphere was marked by feeble intensity until the 20th day, when the electric pole was blown down during a high wind. No observation since.

The month was remarkable for great heat and dryness being 8°2 above the temperature of last July. The amount of evaporation was the most observed here. Small birds quite deserted the fields and villages and retired to the rivers.

The Canadian Journal.

TORONTO, OCTOBER, 1854.

Geology of Western Canada.—No. II.*

(*From the Report of Alex. Murray, Esq., Assistant Provincial Geologist, dated Montreal, January* 1849.)

WESTERN AND HURON DISTRICTS.

General Description of the Coast.

Of the east side of the promontory separating Georgian Bay from the main body of Lake Huron, a general description was given in the Report of last year. The west side is marked by characteristics similar to those which in the same Report were stated to belong to the south side of the great Manitoulin Island. At all parts from Cape Hurd to Rivière au Sable (north) the coast is low, rocky and rugged, and scantily clothed with a dwarfish growth of evergreen trees. It is deeply indented by numerous bays and creeks, and at intervals, bound by groups of small, low and usually barren islands of limestone. As is the case on the southern shores of the Manitoulins, these bays, though frequently capacious, rarely constitute good harbours, the approach to them being at times extremely dangerous, even for vessels of small draught, owing to the shallows which extend for a long distance out into the lake, consequent upon the low westerly dip of the calcareous strata composing the promontory. Safe and commodious places of resort, however, for vessels navigating the lake, are not altogether wanting, and among these probably the best is the harbour of Tobermory, near Cape Hurd, well known to most persons who have frequented this part of the coast. Boats can find shelter in many places, either in coves or creeks, or among the islands, and at the mouth of the Rivière au Sable (north), there is an excellent boat harbour, but a sand-bar at the entrance effectually prevents the admission of vessels drawing over three feet.

Losing its rocky nature, a decided change takes place in the character of the coast, at the Rivière au Sable (north), about the mouth of which, and for seveal miles south, sand dunes prevail; and farther on, a beach of sand, strewed over in parts with boulders, extends some distance beyond the Sauguine. Between the two rivers there is no harbour of any description, and with strong northerly or westerly winds, it is next to impossible to effect a landing, in consequence of the barriers of boulders which lie along the shore at considerable distances from the land, the shallowness of the approach, and a heavy surf which rolls in from the lake. Bordering the lake along the sandy tract there is no amelioration in the timber, which consists for the most part of a mixture of inferior evergreens, with small white birches and cedars, until approaching the Sauguine, where a gradual but evident improvement in the nature of the soil is indicated by the more frequently recurring presence of good sized pines, accompanied with maple, elm and birch. The mouth of the Sauguine affords a good harbour for boats and small craft, but as is the case with all the rivers of the coast, a bar is formed across its entrance, over which a heavy sea breaks when the wind is at all strong from any point between south west and north: its entrance, under such circumstances, is difficult, and attended with considerable danger. At a very short distance up from its junction with the lake, the river becomes rapid and is no farther navigable except for canoes or small boats, and rapids occur at intervals to the highest part we reached, which might be about five miles from the mouth. In these five miles the river flows between banks of clay, gravel and sand, frequently rising boldly to heights of between twenty and a hundred feet over the water; the surface of the country on both sides is flat or gently undulating, and while in many parts it bears a heavy growth of pine timber, in others it yields maple, elm, ash, and other hardwood trees of good size. About two miles from the mouth, on the right bank of the river, there is an Indian settlement, from which a portage has been cut across the peninsula to the Indian Village of Neewash, at the head of Owen's Sound. The territory to the North of the portage being exclusively an Indian Reserve, remains in its primeval state of wilderness; and with the exception of a building which was raised some years ago by a fishing company at Gaheto, or Fishing Island, there is not a single dwelling house on any part of the coast all the way to Cape Hurd, a distance of nearly sixty miles.

Following the coast south from the Sauguine, the land is low, with a beach alternately of sand and boulders, for about six or seven miles, beyond which occasional ledges of rock appear, until reaching the Little Pine River, which enters the lake to the south of Point Douglas. Beyond the Little Pine River the land becomes more elevated, and the character of its forest proclaims a still further improvement in the soil. At the outlet of a stream, dignified, though a mere brook, with the name of the Big Pine River, in which the epithet Big, however, is probably intended to qualify the wood rather than the water, the surface is thickly grown over with pine of large size, and before reaching Point Clark, some nine miles farther, the interior consists chiefly of excellent hardwood land. A beach of fine sand skirts the shore for the whole distance. From Point Clark, the coast which, from the mouth of the Rivière au Sable (north), has a general bearing about S.W. by W., turns due south, and maintaining this course to Port Frank, in the Township of Stephen, a distance of fifty miles, presents to the lake, in almost all parts, steep and lofty cliffs of clay, the summit of which spreads back into an extensive level country, producing a luxuriant vegetation of the heaviest description of hardwood trees. At Port Frank the trend of the coast changes to south west, and again with the adjacent country becomes sandy, presenting innumerable sand dunes, which extend several miles back, and in many instances rise to the height of a hundred feet and more over the surface of the lake. This character prevails to the mouth the Rivière au Sable (south,) and beyond it to within a short distance of Cape Ipperwash or Kettle Point, which is about fifteen miles from Port Frank. Kettle Point displays a few flat rocks coming to the water's edge, but beyond it a fine sandy beach, with high cliffs of clay rising at a short distance back, hold the coast line to within two miles of the entrance of the St. Clair River, where the country again appears to assume an arenaceous character.

In the direction in which we proceeded along this coast,

* In the August number of this Journal we published a Geological Map of a considerable portion of Western Canada, by W. E. Logan, Esq., F.R.S. & G.S., Provincial Geologist. We now propose to furnish monthly abstracts of those portions of the Geological Reports which describe the physical structure of the country comprehended within the limits of the Map. We are induced to adopt this method of disseminating information respecting the Geology of Canada, not only on account of its intrinsic value, but also because it is a matter of extreme difficulty to meet with copies of the earlier Reports, in consequence of the destruction of the reserve during those disastrous conflagrations which destroyed the Parliament Buildings at Montreal and Quebec.

settlements first appear a short distance to the south of Point Clark, the forest being here and there indented with extensive clearings which increase in size and number, approaching Goderich. South from Goderich the principal settlement we observed was at Bayfield River, but the rest of the coast between that river and Port Sarnia, on the St. Clair, is as yet but thinly peopled. Kettle Point and the neighbourhood are still, I understand, in the possession of the Indians, and are in consequence but little cultivated.

With the exception of Goderich harbour, at the mouth of the Maitland River, and the basin at the exit of Riviére au Sable (south,) there is not a single place of security for any description of vessel between the River Sauguine and the St. Clair. Small boats, I was informed, could enter Big Pine Brook, but no craft of larger size. There are no islands, no coves, no accessible brooks or streams, and with strong winds from the south, west or north, it is difficult, if not impossible, to land boats with safety. At many points the water is very shallow and large boulders often lie at a long distance out in the lake, while a very heavy sea breaks every where along the coast.

Distribution of the Rock Formations.

The rocks exhibited upon that part of Lake Huron now under consideration, are portions of the whole suite of fossiliferous deposits between the Trenton Limestone (using the New York nomenclature,) at the base, and the Hamilton Group at the summit, both inclusive; the superposition, in ascending order, being as follows:

1. Trenton Limestone,
2. Utica Slate,
3. Loraine Shales,
4. Medina Sandstone and Marl,
5. Niagara Limestone,
6. Onondaga Salt Group, or Gypsiferous Limestone and Shale,
7. Corniferous Limestone,
8. Hamilton Group.

I. TRENTON LIMESTONE.

As already remarked in former Reports, the Trenton Limestone occupies the whole of the Peninsula between Matchedash and Nottawasaga Bays, and the group of islands lying off its extremity, consisting of the Giant's Tomb, Hope, Beckwith and Christian Islands. At the head of Matchedash Bay, near the entrance of the Cold Water River, the limestones are found with a narrow band of green sandstone below them, resting unconformably upon gneiss, and from that spot a nearly straight line drawn down the Bay to the Giant's Tomb, would mark the lower boundary of the formation, the limestone being seen outcropping at intervals on the south west shore, while the islands and mainland on the opposite side display nothing but the older rock in its various granitic and syenitic aspects. The upper members of the Trenton formation were found about eight miles west from Nottawasaga River at McGlashan's Mills, at Hurontario in the Township of Nottawasaga, at the little islands, called the Hen and Chickens, and on the coast in the N.W. corner of the Township of Nottawasaga, where they were seen to pass below the Utica slate. The tranverse breadth of the formation is thus about thirty miles, and its thickness, supposing the dip to be to the south-westward at the rate of thirty feet in a mile, would be 900 feet. But it is not unlikely that it may be affected by very gentle undulations and it would therefore be scarcely safe to state the probable amount at more than 600 to 700 feet. The arenaceous portion of the formation, distinguished by the New York geologists as the Calciferous sand-rock, is usually found at the base, and beds more or less silicious occur at intervals throughout the whole thickness. Green calcareous and argillaceous shales are also frequently met with, usually holding numerous fossils, and alternating with beds of good limestone; the pure limestones are sometimes of a buff color and very fine texture, in which case fossils are scarce, those in such instances most prevalent, being small fucoids generally replaced by calcareous spar, running through the beds vertically to the plane of stratification. Other beds are gray in color, granular and crowded with fossils. Among these beds some hold the tail of a trilobite (*Isotelus gigas*) in great abundance, while others are almost exclusively composed of the remains of a species of *Leptena*. The fossils observed to prevail throughout the formation were several species of *Leptena*, *Cypricardia*, several spiral univalves, orthoceratites, trilobites, chiefly *Isotelus gigas*, encrinites, corals and fucoids.

In the variations in mineral quality in different parts of the formation, some beds are so very arenaceous and hard as to be altogether unfit for burning into lime, or where not too silicious for such a purpose, the lime assumes when slacked such a dark yellow color as to unfit it for white-washing, while it permits but a small admixture of sand in forming mortar. Other beds on the contrary are uncommonly free from silicious matter, and are then often bituminous, and sometimes have a slightly argillaceous aspect. The lime from these beds is of excellent quality.

II. UTICA SLATE.

Black bituminous shales come to the surface on the coast of Nottawasaga Bay, in the fourth concession of Collingwood, with beds of close-grained, dark-brown bituminous limestone interstratified. The limestones contain fossils, but by no means in such abundance as the shales, which are uncommonly productive, the prevailing fossil being the tail of the *Isotelus gigas*, which greatly predominates, but is accompanied by *Triarthus beckii*, *Orthis*, *Lingula*, *Orthoceras and Graptolithus.*

III. LORAINE SHALES.

The first exposure of the formation we met with on our route along the coast was near Cape Boucher, in Nottawasaga Bay, where cliffs rising abruptly to the height of 150 feet, present sections of buff or drab-colored argillaceous shales, interstratified with thin beds of gray yellow-weathering sandstone. It next makes its appearance at Point Rich, and continues exposed, in a high nearly vertical cliff, thence to Point William, where we found blue and drab-colored argillaceous shales, with thin alternations of calcareous sandstone and thin beds of limestone. The upper part of the formation was observed in a cliff about 100 feet high at the head of Owen's Sound, immediately over the steam-boat wharf, where the base of the precipice displayed shales of a similar character to those at Point William, which were overlaid by hard beds of gray or brownish yellow-weathering silicious limestone capping the summit. Portions of the formation are seen at Cape Commodore, on the islands opposite to Colpoy's Bay, at Cape Croker, and other parts of the coast, until reaching Cabot's Head, where they were observed to pass below the Medina rocks, as noticed in the Report of last year. If a straight line were drawn from Point Rich to Cape Croker, to represent the outcrop of the base, the formation would have a breadth of about twenty miles at Owen's Sound, which, at the supposed slope of thirty feet in a mile, would give a thickness of about 600 feet.

Fossils are found in vast abundance, but unequally distributed through the formation. In the section near Cape Boucher they consist chiefly of stems of encrinites and pentacrinites and also fucoids, shells of all kinds being very scarce. At Point

William shells are more plentiful, but not in great abundance, while at Cape Croker and Cape Montresor various species of shells occur in great numbers, in addition to encrinites, corals and fucoids. In the hard beds at the top of the formation, in Owen's Sound, we met with numerous fossils; they were principally small shells and corals, and the forms having been replaced by silica, while the imbedding matrix is calcareous, they were weathered out in relief on the exposed surfaces, being precisely in the condition in which similar remains were found in the upper beds of the same series last season, at Cabot's Head and in the Grand Manitoulin Island. The species of *Pterinea* (*P. carinata*) which appears to be peculiarly characteristic of this series of rocks, is found more or less abundantly in different parts throughout the whole vertical thickness, and in great numbers at Point William, Cape Croker and Cape Montresor.

Concretionary nodules of calcareous quality, usually assuming spheroidal or sub-spheroidal shapes, are thickly scattered through the shales in some parts of the formation, and were observed in particular among the rocks in the neighbourhood of Cape Boucher.

The materials of economic importance observed associated with the Loraine shales, were stones fit for building, for tiles and flagging, with limestone and clay. For building, the hard beds at the top of the series, are of tolerably good quality, when the layers are not too thin, which however they frequently are, and some of the calcareo-arenaceous bands might be used for a rough description of tiles and flagging; but the material is of an inferior quality for either purpose. There are very few beds fit for burning into lime; an occasional one, however, is met with among the blue and drab shales. When not too calcareous, the clays derived from the disintegration of the shales constitute material of good quality for brick making. Gypsum is reported to have been found in the formation near Cape Commodore, but the only specimens of it met with by me occurred in small isolated masses of no economical importance, being such as are known to exist in the formation elsewhere.

IV. V. MEDINA SANDSTONE AND NIAGARA LIMESTONE.

A bold precipitous escarpment marking the outcrop of the Niagara limestones, was traced along the coast during the season of 1847, from Cabot's Head to Colpoy's Bay. Southward from the bight of this bay, the escarpment leaves the coast, but maintaining some degree of parrallelism with it, sweeps round towards the heights over Cape Commodore, whence it runs nearly due south, keeping two or three miles distant from the west shore of Owen's Sound, until reaching the line between the Townships of Derby and Sydenham, about three miles south of the village of the latter name at the head of Owen's Sound, where it strikes to the south-eastward and crosses the Owen's Sound road. The subjacent formation was not exposed at any part that we visited south of Colpoy's Bay, being concealed by detritus and forest trees, but the soil at the base of the Niagara escarpment was frequently observed to be of a red color and marly quality, leaving little doubt that it was derived from the immediately proximity of the marls of the Medina group.

The upper part of the Niagara limestones, which constitutes the south shores of the Manitoulin Islands, strikes from Horse or Fitzwilliam Island across to the Isle of Coves, then to Cape Hurd, whence it holds the coast and adjacent islands to Chief's Point and the Rivière au Sable (north;) from this, striking into the interior, it is no more seen on the lake. Rocks belonging either to the summit of this or to the base of the succeeding superior formation were seen at Galt, on the Grand River, and beds belonging to the Niagara Group, were observed occasionally coming to the surface, on the road between Galt and Dundas, but the country north of Galt, and between it and the mouth of the Rivière au Sable (north,) has not yet been examined, and I am unacquainted with the details of the geographical boundary of the summit of the formation in the interval, which is nearly a hundred miles.

Numerous fossils were observed in the Niagara limestones, but the variety was not great except among the corals, which were of many different species. The most characteristic shell was a *Pentamerus*, which extended through the whole formation, but was most abundant near the top; *Euomphalus* and other spiral genera were met with; a large bivalve of a new genus occurred in great numbers at Galt, associated with *Pentamerus*.* Among the thin-bedded limestones at the base of the formation (corresponding probably with the Clinton group portion of it,) some surfaces were thickly covered with organic remains, an *Atrypa* and a small turbinated shell chiefly prevailing. Trilobites, orthoceratites, corals and fucoids also, though in less abundance, were observed in this portion, but principally in one place near Cape Chin, on the south side of Dyer's Bay.

The Niagara group is fruitful in excellent materials for building and lime burning. At Galt white limestone occurs of a beautiful and enduring quality for architectural purposes, for which it is extensively quarried from beds nearly horizontal, varying from one to three feet thick, and blocks may be obtained of almost any required size without much difficulty; the stone burns also to an excellent lime. At Owen's Sound, about two miles S. by E. from the village, there are unworked strata of white or pale grey limestone; the upper beds are from two to four feet thick, the lower ones occasionally over twelve feet, being all very massive; the upper beds could be quarried to an almost boundless extent, and would yield an excellent building material; the lower beds are likewise fit for building purposes, but being the base of an abrupt escarpment could not be extensively quarried; large loose masses, however, skirt the escarpment, and these might be made available for a great length of time. All the beds would stand the weather well; many of them have occasionally been burnt by the settlers, and are said to make an excellent quality of lime. Materials of much the same sort would be found all the way to Cabot's Head. On the Riviére au Sable (north,) about a mile and a half or two miles from its mouth, there are some pale greenish-blue limestone beds, one of them darker than the rest, which would all be fit for building purposes; the stone appears to resist the disintegrating influences of the weather well, but it turns under them to a blackish color. The beds are from eight to eighteen inches, and even two feet thick; they are divided by parallel joints into rhomboidal forms, and would afford blocks of any required size. At Chiefs' Point there is a limestone which presents a white or pale gray color on fracture; it has a rough pitted exterior surface, and weathers to a dark brown approaching to black; the beds are massive, ranging from two to four feet in thickness; parallel joints intersect them, and they could easily be quarried, and afford a very substantial building stone: most of the beds are supposed to be fit for burning into lime.

* Since Mr. Murray's examination of the rocks at Galt, Mr. Hall, of New York, has visited the spot, and in addition to the new bivalve, above mentioned, to which he proposes to give the name of *Megalamus Canadensis*, he has met with other shells, two of which he recognises as belonging to the Onondaga Salt Group, or Gypsiferous Limestone, and he is disposed to class the Galt rocks with that formation.—W. E. L.

Lyell Island and the Fishing Islands give a stone precisely similar to that of Chiefs' Point and under exactly similar circumstances; and so indeed does nearly the whole coast to Cape Hurd, on which the rocks, running on the strike, are exposed nearly the whole way. Hitherto the only trial that has been made of this part of the formation is on one of the Fishing Islands, where a house, to which allusion has already been made, was constructed some years ago by a fishing company for the superintendent.

Biographical Notice of Sir Roderick Murchison.*

Sir Roderick Murchison was born on the 19th of February, 1792, at Taradale, a picturesque estate on the Beauly Loch, and was the eldest son of Kenneth Murchison, Esq., of Taradale, by the sister of General Sir Alexander Mackenzie, Bart., of Fairburn, in the same county, a distinguished officer, who was second in command at the capture of the Cape of Good Hope, in 1795, and subsequently served in the Mediterranean. The Murchisons derive their descent from Colma, (subsequently M'Colmans,) the son of Anselm, a son of Ryan, King of Ulster, who had been driven from his country by the Danes. One of the M'Colmans, called Murdo or Murcho-du, settled in Kintail, in Ross-shire; but the family fell into comparative poverty. One of his descendants, John Murchison, the great grandfather of our author, who held a Major's commission in King James's army, fell, at the age of thirty-five, in the battle of Sheriffmuir. His grandson Kenneth, our author's father, born in 1752, was educated for the medical profession, and held lucrative appointments in India. He was the friend of Hastings, Impey, and Sullivan; and after his return to Europe he purchased the estate of Taradale from his maternal uncle, Mr. Mackenzie of Lentron. It is a curious circumstance that he kept journals written in Gaelic and in the Greek character,—a fact which may probably have been known to Macpherson and John Home, who had at one time proposed to have the poems of Ossian printed in the same character. Having, on account of his health removed to England in 1794,—he died at Bathampton, near Bath, in 1796, in the forty-fourth year of his age. Inheriting the martial spirit of his uncle, young Murchison chose the profession of a soldier, and while imbibing the first elements of learning, at the school of Durham, under Dr. Britton, to which he went in 1799, he exhibited among his school-fellows that daring spirit and recklessness of danger which so well harmonizes with the ambition of military adventure. On one occasion he performed, to the wonder of his school-fellows, the hazardous feat of getting outside of the balustrade of the great tower of the cathedral, and seating himself on a corner spout projecting from a dragon; and at another time he began his career of subterranean exploration by crawling, as we have heard him say, in the society of rats not yet fossilized, along the conduit which begins at the Watergate and terminates at the river Wear, where he was received with open arms by his admiring school-fellows.

From the grammar-school of Durham he went, in 1805, to the Military College of Marlow, where he remained till 1807, when, at the age of fifteen, he got a commission in the 36th regiment of foot. By the interest of his uncle, Sir Alexander Mackenzie, he was transferred to the University of Edinburgh to pursue his studies, at a time when he had a recruiting party under his orders in the town. He was boarded in the house of Mr. Manners, then bookseller, and librarian to the Faculty of Advocates, where he had among his associates the late M. Schwertzkoff, who died when Russian Minister at Florence, and the present Sir Thomas Birch, M.P. for Liverpool, and private secretary to Lord Melbourne when his lordship was Chief Secretary in Ireland. Our young Ensign does not seem to have drawn much wisdom from the Modern Athens, or to have acquired, in his University studies, any knowledge in those branches of science to which he was afterwards devoted.

After he had joined his regiment at Cork, in the winter of 1808, it was moved to Fermoy, when it was suddenly ordered to embark for Portugal under Sir Arthur Wellesley. After the army landed at Lisbon and advanced into the interior, he was present at the battle of Roleia, where General Laborde was defeated on the 17th August; and he carried the colours of his regiment, the 36th, when it so nobly distinguished itself at the battle of Vimiera on the 21st of August. Sir Arthur's despatch specially recommended Colonel Burne, who commanded the 36th, and, what was unusual, he devoted a whole paragraph to the praise of the regiment. Having observed the brilliant charge executed by General (afterwards Sir Ronald) Ferguson's brigade, of which the 36th formed the right, and noticed the manner in which they captured the enemy's guns, and drove them across a moor away from their main body, Sir Arthur followed them at a gallop from the centre, where he had repulsed Junot in person, and reached them only at a hamlet where the French were rallying in their front. At this moment our author's brother Ensign was shot. In the confusion and din of the fight, a shrill voice was heard, "Where are the colours of the 36th?"—"Here, Sir!" replied the young Ensign. The regiment was immediately halted, and the welcome sound of "Very well, my boys," conveyed the satisfaction of their distinguished chief. Our limits will not permit us to follow our young soldier in his military career in the Peninsula. He accompanied the army in its advance to Madrid through cold and snow to meet Soult; and after its retreat, and junction with Sir John Moore, he was present at the battle of Corunna, and shared in all the dangers of that unfortunate event. He was subsequently removed to the staff of his uncle, General Sir Alexander Mackenzie, in Sicily, and afterwards served in the Mediterranean at the siege of Cadiz, and in Ireland as a captain in the Inniskilling or 9th dragoons. Amid the excitements and dangers of war, the germ of science which Nature had planted within him had not yet shown its peaceful foliage, and, though his eye dwelt on the fine gorges and rugged outlines of the mountain ranges between Spain and Portugal,—on the masses of granite in the famous pass of Guadaramma,—he was not aware that he was treading upon Silurian pavements, which, in other countries, it was to be the business of his life to explore.

In 1815 he married the only daughter of General Hugonin, a lady of congenial taste and great accomplishments; and, considering the married state as incompatible with the duties required from a soldier, he left the service, and sought for amusement and instruction in foreign travel, and, when at home, in the occupations of the sportsman and fox hunter. Destined, however, for higher objects, it required only the voice of affection and friendship to remove him to more rational and more congenial pursuits. Herself a good florist and botanist, Lady Murchison attracted him to scientific studies, and having thus been initiated into the temple of knowledge, it was not difficult to fix him at its shrine. When in company with Sir Humphry Davy, and engaged with him in field-sports at the hospitable

* Abstract of an article in the North British Review for August, 1854.

mansion of the late Mr. Morritt of Rokeby, he was encouraged by that eminent chemist to devote himself to science, and, at his advice, attended the Lectures at the Royal Institution. Here he acquired his first lessons in science between 1822 and 1824, and having been elected a member of the Geological Society in 1825, he at once entered upon the duties of a practical geologist. In the following year he was admitted a Fellow of the Royal Society, and thus took his place among the philosophers of England.

After examining the Brora coal in Sutherlandshire, and showing that it was a member of the Oolitic series, aud equal only to the impure coal of the Oolite of Scarborough and Whitby, our author visited the Highlands in the following year with Professor Sedgwick, when they succeeded in showing that the primary sandstone of Macculloch was nothing more than the true old red sandstone.

Thus prepared by his geological studies at home, our auther, accompanied by Lady Murchison, set out in 1828, along with his distinguished friend Mr. Lyell, to study the extinct volcanoes of Auvergne, and the geology of the north of Italy. In this tour they visited Paris, Avergne, the south of France, Nice, and Turin. The results of this diversified journey, which Mr. Lyell by himself extended to Rome, Naples, and Sicily, were partly published in his "Principles of Geology," and partly in three Memoirs, the joint production of the two geologists. These Memoirs were on the excavation of Valleys, as illustrated by the volcanic rocks of Central France, on the tertiary strata of the Cantal, and on the tertiary fresh water strata of Aix, in Provence.

After separating from his companion, who contiued his journey to the South, our author crossed the Alps from Venice and Bassano, and in the journey he discovered a key to establish the order of sequence of the Jurassic or Golitic and Cretaceous rocks, and the Tertiary strata which overlap them; and having in 1829 visited the same mountain chain in the following year, along with professor Sedgwick, and again in the year 1830 by himself, he was enabled with the assistance of his friend, to publish a Memoir in the Geological Transactions on the structure of the Eastern Alps, accompanied by a Geological Map of the chain.

After these explorations of the Alps, Sir Roderick directed his attention to the geology of his own country. He had been led by his friend and instructor Dr. Buckland to explore the banks of the Wye between Hay and Builth, in the hope of discovering evidences of order among those masses of rock to which the unmeaning term of grauwacke had been applied, and he was thus led to study those vast and regular deposits of a remote age, which are most clearly displayed in that part of Wales and England which was occupied by the Silures, and which he called the *Silurian System*. After having established the existence of the system in the counties of Shropshire, Hereford, Montgomery, and Radnor, he traced it to the southwest, through the counties of Brecknock and Caermarthen, and finally discovered the whole successiou of the upper and lower Silurian rocks, in the sea cliffs to the west of Milford Haven,—the only place in the British Isles where the whole series, down to an unfossiliferous base is seen to be regularly surmounted by the Old Red Sandstone.

These views were first published in the proceedings of the Geological Society and in the Philosophical Magazine, between the years 1832 and 1835, both inclusive; the term *Silurian* having been applied to the series in the last mentioned year. At that time it was believed that the great slaty masses of North Wales, which had been under the survey of Professor Sedgwick, but whose fossils had not been made known, were inferior in position to the formations which had been classed, and whose fossils had been identified, as *Silurian*. This belief continued to be in force when the large work entitled the "Silurian System" was published, (1839,) the *supposed* lower rocks having been termed *Cambrian* in 1836, by their explorer, Professor Sedgwick; it being then presumed that this would prove to contain a distinct group of organic remains. When the masses, however, to which the name *Cambrian* had been given, were examined in detail by the numerous geologists of the Government Survey, and were thus for the first time, placed in correlation with the previously established Silurian strata, it was found that the great and apparently chaotic pile of Snowden, though full of porphyry and other igneous rocks, was nothing more than the absolute physical equivalent of the Llandeilo formation of the Lower Silurian, and hence these gentlemen, with the entire approval of Sir H. de la Beche, the founder of the great national Geological Museum in the Metropolis, restricted the term Cambrian to the underlying grauwacke without fossils. When we add to these considerations the fact that Silurian fossils are alone found in what were called Cambrian rocks, we cannot avoid adopting the opinion expressed fourteen years ago in one of his anniversary addresses by Sir R. Murchison on his return from Russia, and which has since been maintained by the great body of geologists,—Continental, American, and British,—that the so-called "Cambrian" rocks which contain fossils, are merely geographical extensions (under those different mineral characters so admirably described by Professor Sedgwick) of the lower Silurian deposits of the typical region of Sir R. Murchison in Shropshire and the adjacent counties. But passing by this subject of nomenclature, the difference about which is feelingly alluded to in his preface by our author, we cannot view the question as affecting the acknowledged merits of the distinguished Cambridge Professor, who, whatever be the names of the rocks, will ever occupy the same lofty place in the history of geology to which his labours have so justly entitled him, and whose praises are emphatically recorded in the volume under review by his associate in many a field of research.

Without particularly noticing the two journeys which were performed by our author and Professor Sedgwick in 1835 and 1839 into the Rhenish provinces, including the Hartz district and Franconia on the one side, and Belgium and the Boullonais on the other, in the last of which they were accompanied by M. de Verneuil, we must hasten to give a brief account* of the remarkable journeys which he made to Russia in 1840 and 1841, in company with M. Verneuil, whom he invited to accompany him. Our geologists reached St. Petersburg in the summer of 1840, and after visiting the banks of the rivers Volkof and Siass, and the shore of Lake Onega, they proceeded to Archangel, and the borders of the White Sea, and followed the River Dwina into the Government of Vologda. After traversing to the Volga they returned by Moscow to St. Petersburg, examining the Valdai Hills, Lake Illmen, and the banks of the rivers which they passed. Mr. Murchison returned to England in 1840; but having, along with M. Verneuil, been invited by the Emperor to superintend a geological survey of Russia, our two geologists travelled overland to St. Petersburg in the spring of 1841, and being joined by Count Key-

* In the *North British Review*, Edinburgh edition, vol. v. p. 183 where is reviewed "The Geology of Russia in Europe," our readers will find a fuller account of these journeys, and their results.

serling and Lieutenant Koksharof, they proceeded to explore the Ural Mountains, the southern provinces of the empire, and the coal districts between the Dnieper and the Don. In order to render his great work on Eastern Europe as perfect as possible, our author alone travelled, in 1842, through several parts of Germany, Poland, and the Carpathian Mountains; and with the same objects in view, he explored successfully, in the summer of 1844, the Palæozoic formations of Sweden and Norway. He afterwards re-visited St. Petersburg, and after communicating with Count Keyserling on the subject of the Petchora and Timan country, which had been explored by that geologist, and examining some newly-discovered natural relations of the strata, not very distant from the capital, he returned to England, and completed in 1845, in conjunction with M. de Verneuil, that magnificent work on the geology of Russia and the Ural Mountains, of which we have given a full account in a preceding article.

Before quitting our enumeration of the geological works of Sir Roderick Murchison which preceded the one now under review, we must notice his remarkable treatise on the Alps, Appennines, and Carpathians, published by the Geographical Society, in which, after visiting the Alps for the sixth time, he clearly separated the great Nummulite formation from the chalk and other cretaceous deposits with which it had been confounded. This treatise was translated and published in Professor Savi and Menegheiri's work entitled *Le Alpi et gli Apennini*, in which they adopt the general views of the English geologists, and append to it the details of their own observations on the geology of Tuscany. In addition to the works we have enumerated, Mr. Murchison has published upwards of a *hundred* memoirs, a list of which will be found in the *Bibliographia* of Agassiz, published by the late Mr. Hugh Strickland.

But it is not merely by his geological discoveries and writings that Sir Roderick Murchison has earned the gratitude of his country and his reputation in the world of science. After having for five years discharged the arduous duties of secretary to the Geological Society, he filled the office of president in the years 1831 and 1832, and 1842 and 1843. When the British Association assembled at York for the first time in 1831, he was one of the few geologists that responded to the invitation of its founder, and fully appreciating the value of such an institution, he discharged the arduous duties of general secretary for several years, and was president of the Southampton Meeting in 1846. In the important discussions which took place in the geological section he took an active part; he communicated many important papers to its different meetings, and at Ipswich in 1851 he succeeded in establishing the new section of physical geography, ethnology, and philology, thus removing geography from the geological section, in which it was overborne by more popular topics of discussion.

Not less important have been the services of Sir Roderick to the Royal Geographical Society, now one of the most popular and flourishing institutions in the kingdom. When the Society was not in its most active state, he was raised to its presidency in 1844, and was re-elected in 1845; and the energy and talent which he displayed in promoting the objects of the Society are sufficiently shewn in the two printed annual addresses which it is the duty of the president to deliver. At that time the Society had no house of their own, no suitable apartments for the reception of their numerous collections of maps and charts; and hence during the year of the Great Exhibition, in 1851, when the Emperor of Austria presented to it the valuable framed maps which were exhibited in the Crystal Palace, no other place could be found for them than the walls of the staircase which led to their small meeting room.—This was not the proper condition of a society which bore the name of *Royal*, and adjudged annually two royal medals; and the indifference of British Ministers to the interests of science, even when the nation derives from it the most palpable advantages, is well displayed in their treatment of this most useful institution. Sir Roderick Murchison had in 1844 and 1845, failed in obtaining from Sir Robert Peel any pecuniary aid, and when, during his second presidency in 1852, he made a new appeal to the nation, he might have equally failed, had he not proposed that the Society should repay any obligation conferred upon it by the Government, by "rendering one of its rooms a *map office* of the British nation, in which all persons might have access to maps, charts, and plans, many thousands in number." This appeal to the utilitarian conscience succeeded, and we believe that it was chiefly through the exertions of Mr. Joseph Hume that the sum of £500 was wrested from the national purse, never closed but against science, to enable the Geographical Society to receive presents from foreign sovereigns, and carry on researches honorable to the nation, and subservient to the highest interests of its trade and commerce. We have reason to believe that Sir Robert Peel was ashamed of his illiberality to the Geographical Society. We know at least that after he had associated, as he did in the latter part of his life, with many of our most distinguished men of science, he did more to promote its interests than all the ministers that preceded him, and all those, too, that have followed him as advisers of the Crown. Had his valuable life been spared, the science of England would have wanted neither money from the Treasury to advance its interests, nor honours from the Crown to reward and stimulate its cultivators. His successors have yet to learn as he did, the national value of education and knowledge, and require to be taught that if they have not the liberality to foster and extend the educational institutions of the country, it is at least their duty to maintain them, and especially those of Scotland, of which her Majesty is the visitor, in the possession of their original endowments.

Among the other services to his country, and one for which his native Scotland owes him peculiar obligations, we must not omit the great and successful exertions which he made to promote the Ordnance Survey of Scotland. While £850,000 was expended on the Ordnance Survey of Ireland, in procuring for that country a magnificent map on the scale of *six inches to a mile*, almost nothing was done for the map of Scotland, though the survey of the country commenced in the last century. Humiliated by the reflection that Scotland stands almost alone in Europe as a kingdom without a good general map, and experiencing how much geologists and engineers were perplexed by the want of such an auxiliary in their researches, Sir Roderick roused the public attention to the fact in 1834.—The British association in 1834 presented to Government a memorial on the subject, which was printed in 1835 by order of the House of Commons; and the Royal Highland Society and other public bodies, seconded their exertions. The apathy of the Government, however, to everything like science, and especially to Scottish interests, was not overcome even by their powerful influence; and a fresh agitation in 1850 was required to awaken the Scottish members to a due sense of the interests which they had unwarrantably neglect and obtained from a reluctant Legislature the necessary means for carrying on and completing the survey of Scotland.* A grant of £25,000, and

* See *North British Review*, Edinburgh edition, vol

subsequently of 35,000 per annum was made to this great work; but judging from the past, and knowing how little trust is to be placed in public men who have been driven to the discharge of a duty, not by the impulse of knowledge, but by an overwhelming pressure from without, we fear that the necessities of war will be employed as an excuse for neglecting this and all the other works of peace.

We have already had occasion, in a previous article, to mention the honours and rewards which were conferred upon Sir Roderick Murchison by the Emperor of Russia, in consideration of his services in investigating the geological structure of that vast empire. The scientific institutions of Europe have equally recognised his services to science, and we find his name in the list of members of the Imperial Academies of Science of St. Petersburg, Berlin, and Copenhagen, in that of the corresponding members of the Imperial Institute of France, of the Royal Society of Edinburgh, of the Royal Irish Academy, and of the Trustees of the British Museum. In enumerating these honours, we may add that he has long been an active member of the Royal Society of London, and that he has received the honorary degree of M.A. from the Universities of Cambridge and Durham, and of D.C.L. from that of Oxford. In 1846 he received the honour of British knighthood—the cheap reward which an ungrateful country offers in exchange, to-day, for professional sacrifices and national benefits; to-morrow, for political subserviency and corruption. The last service which Sir Roderick has performed to geological science is the publication of the work entitled *Siluria*.

Important Improvement in the Manufacture of Iron and other Metals by the Introduction of a Liquid Purifier.

The advantages derivable from this new principle (the liquid purifier) are being fast appreciated. Among other establishments where the indefatigable discoverer has been, may be noticed the paper-mills belonging to the highest civic authority of the borough of Birmingham, who received him with his usual kindness and urbanity; and having listened attentively to Mr. Phillips's statement of its effects on metals, and of what he proposed doing at the paper-mills, the Mayor at once went with him to the mills, and whilst the machine was in operation, Mr. Phillips's introduced a small quantity of the liquid: in about a minute a piece of paper was produced of decidedly different texture to the bulk then making. This is, of course, not to be considered a fair test or experiment, but merely as showing the extraordinary power of the liquid purifier, whether applied to hard or soft substances. Instances of its effect on other articles can be equally well authenticated; but enough is here shown to prove that various sources of our national prosperity are likely to derive advantage from its introduction into the factories at Manchester and elsewhere, and to which, we understand, it is Mr. Phillips's purpose to turn his attention as soon as he has firmly fixed the practical application of it in the metal trade generally.

As respects copper, brass, &c., we beg now to state that on the introduction of the liquid purifier into the crucible or melting pot (either in or out of the furnace), whilst the metal is in the proper melted state, it brings up almost immediately all the dross and impurities, which the present imperfect mode of fluxing is incapable of doing; this, of course, renders the metal better, and the castings made, whether into ingot or work, are superior, being stronger, tougher, and more solid, consequently better for boring and turning. Its practical working and economical properties have been fully proved, and it may be stated that lighter or thinner castings will be equally strong, and much neater than those in present use; that wire and other things requiring increased strength, in proportion to size, may be made and used thinner than at present; and that ingot metal, being more pure, will be increased in value, and, consequently, will go further in manufacture. This has been frequently tested, particularly as regards the commonest sort of stuff, such as brass filings, which by the new purifier is rendered a good metal, and fit for use again; and although it loses considerably in weight by the new process as compared with the old, yet, on being valued for its metallic properties, after being cast into ingots by the old and new process, the advantage is always found to be on the side of the later, besides having a good metal to work upon; so that if the manufacturer desires to lower in quality, he can do so to suit his purpose and work. This advantage alone, independent of every other, must be of great benefit to the manufacturer and to the public, producing profit to the one and economy to the other.—*Mining Journal.*

New Zealand Flax.

The open hostilities in which this country is at present engaged with Russia, have rendered it incumbent upon us to seek substitutes for articles, the produce of that empire, on which we have been dependent, amongst them for Russian hemp. The demand for paper in this country has also so outgrown our usual sources of supply, that we are forced to seek for new fibrous substance suited for its manufacture, and the New Zealand flax seems to be one well calculated to meet in a great measure these requirements. The *Phormium tenax*, or New Zealand flax grows in great luxuriance in every part of the islands of that vast district, the flax being contained in the leaf of the plant, covered with green cuticle, which requires to be peeled off, and a viscous, gummy substance removed, the precise nature of which is as yet unascertained, before the fibre can be obtained. This cleansing has been as yet but imperfectly accomplished, although the highly valuable qualities of the plant have been long known to the colonists, and it has been used immemorially by the natives, who have only as yet attempted the operation of hand-scraping the leaves in a green state. It has been for the last twenty years an article of limited commerce; but the difficulty of preparing it for use, from the want of proper means and machinery, had been so great, and the cost so considerable, as to have hitherto rendered it unsaleable at a remunerating price.

Aware of these difficulties, and of its increasing commercial value, the Society of Arts at Wellington, New Zealand, lately proposed a premium of fifty guineas to any person who should furnish them with modes of operation, models, and specifications of machinery, by which the flax might be dressed at a cost not exceeding £5 per ton, and the Council expressed their opinion, "that the time may not be very far distant when the navy and mercantile marine of Great Britain will be supplied with cordage and sails from the hitherto comparatively useless New Zealand flax." This announcement naturally attracted attention and accordingly a small hand-revolving machine has been constructed, making 60 revolutions per minute, at each of which revolutions two green leaves are passed through, completely macerated, and forced on to a second part of the machine, which frees the fibre from the gum-resinous substance with

which it is coated. This gum has been considered the cause of its brittleness, and has hitherto been only removed by steeping in running water, and by stamping and beating, a very slow, imperfect, and expensive process. The second part of the machine then discharges the macerated leaves into a small stream of water, where the mucilage is washed off by women and children, who merely draw the fibre of each leaf through the hand, and wring it out, it is then hung up to dry under cover. It requires 8 tons of green leaves to produce 1 ton of fibre; but the inventor of the machine has had dried leaves from New Zealand ten feet in length, containing an exceedingly coarse but very strong fibre suitable for ropes and cordage. There are several varieties of the plant, the fibre in each varying in quality, applicable to the manufacture of fabrics for which silk, cotton, flax, wool, and hemp are used; the fine tow, we are assured, forms a beautiful yarn, and the flax takes colour as well as any textile fibre. Water-power abounds in the colony, and if applied to this machine on a large scale, a supply may be obtained sufficient for every purpose.

The flax has been grown in nurseries in Devonshire, and, we believe, in Wales; if so, we see no reason why its culture may not be extended in these islands. The Devon leaves, we are assured, average about 6 feet in length, and although worked by the machine in the dry and not in the green state, each leaf produced 3 ozs. of green fibre. Paper manufactured from this fibre possesses the singular quality of being impervious to water; a sheet of paper folded in the shape of a basin, and filled with water, has been kept suspended for 14 consecutive days, without any appearance of dampness on the exterior; for cartridge-paper, therefore, it would prove invaluable, as well as for preserving polished steel and iron goods. It takes tar as well as European hemp; the relative strength of rope made from the New Zealand fibre and Russian hemp has been tested at the Royal Dockyard, Woolwich, when it was found that a 4½-inch made of the former was 60 per cent. stronger than 4½-inch made of the latter. Running gear and ship tackling of cordage made of this invaluable substance has been used in ships trading between London and New Zealand, and highly approved of; and flat-ropes have been made from it for use in the deep coal-pits of Lancashire, where they are preferred to those of Russian hemp, when supplies can be obtained.

We have thus produced in one of our new colonies, in an unlimited quantity, an article calculated to supersede the hemp of Manilla, America, and above all, of Russia. This invaluable production of the earth covers many thousand acres of the soil to which it is indigenous; and it is remarkable, that the higher the altitude at which it grows, the shorter the leaf and the finer the fabric it produces. The want of proper machinery for its production has hitherto prevented the shipment of it in quantity to Europe; the proposed plan will probably remedy that evil, and in time ensure an ample supply. We have thought it right to direct the attention of commercial men to this very interesting and important national object: the drain for European labour in Australia renders it desirable that the natives should be employed extensively in this manufacture, the simplicity of the new machinery suits it for being worked by them, and we hope to see the Zealand flax properly and extensively prepared by the improved process, attain the position in the European markets which its valuable qualities appear so fully to merit.—*Mining Journal*

Incrustation in Boilers.

Mr. Washington Jones exhibited to the meeting of the Franklin Institute, July 20, some specimens of scale, or incrustation, taken from the boiler of a coasting steamer. One piece about twelve inches long, by eight wide, and about three-eights thick, was formed on the outer portion of the furnace crown, and distinctly showed the form of that part of the boiler, with each rivet head and the joinings of the sheets. The scale had been deposited in layers that were of various tints, derived from the colouring matter extracted from the substances (such as saw-dust of mahogany, &c.), that had, from time to time, been put into the boiler to prevent the deposit of scale. Another piece of irregular shape, had been taken from the steam chimney. It is well known that scale is a non-conductor of heat. It forms most rapidly, as a necessary consequence, upon those parts of the boiler where the heat and the evaporation is the greatest, and thus increases the liability these parts have to become overheated or burned.

Mr. Jones also presented a stay bolt taken from the smoke-pipe, where its head had been for over two years exposed to jets of exhaust steam. The part of the head against which the steam impinged, had been cut or worn away by its action; the texture of the iron was close, and the wasted part was as smooth as if cut with a keen tool.

Mr. Jones remarked that the proper construction and maintenance of steam boilers in a safe condition, should be of special importance not only to engineers, but to the whole community. No part of the apparatus requires closer attention. As a class, our steamboat engineers are fully competent to discharge the duties belonging to their post; but, occasionally, the desire to make a quick run, induces them to carry a little higher steam, and to "blow out" less frequently, a practice to be deprecated, as it is almost sure to bring upon them the labour of "scaling", as well as risking the efficiency of the boilers.—*Journal Franklin Institute.*

Lighting by Electricity.

Letter of MM. Deleuil & Son, to M. Elie de Beaumont.

We communicated to the Academy, some time ago, a note in reference to the electro-lighting of the Napoleon Docks. M. Regnault, the director of the telegraph of the Rouen Railroad, who took charge of this lighting, has communicated to us the statement of the expense, of which we herewith send you the details. We thought everything connected with this lighting would be favorably received by the Academy. The apparatus which worked for four consecutive months with great regularity, were composed each of a battery of fifty Bunsen elements of large size.

The expense per day apparatus, was as follows:

Wages of the workmen, ...	4·50	francs.
Mercury, ...	5·	"
Zinc, ...	4·50	"
Charcoal points, ...	1·40	"
Nitric Acid, ...	1·80	"
Sulphuric Acid, ...	1·84	"
	19·04	" ($3·80)

The expense of lighting 400 workmen was, then, 38·08 francs

($7·62) per evening, or 1·9 cents per man. The economy is considerable, and the work can be done without danger and with a regularity which cannot be obtained by any other means.

The Perpetual Secretary remarked, that electro-lighting which could be very cheaply established on ship-board, and which is not, like other systems of lighting, liable to be extinguished during a storm, would be very advantageous for preventing those collisions by night which are so frequent, and generally so disastrous, and to which attention has been called by a recent event.—*Comptes Rendus.*

On Changes of the Sea-Level effected by existing Physical Causes during stated periods of time.

BY ALFRED TYLOR, F.G.S.*

Introduction.

The First Part of the ensuing paper is occupied with the details of the probable amount of the solid matter annually brought into the ocean by rivers and other agents, in suspension and solution; and the conclusion is arrived at, that the quantity of detritus thus distributed on the sea-bottom would displace enough water to cause an elevation of the ocean-level to the extent of at least 3 inches in 10,000 years.

In the Second Part an endeavour is made to compute the number of such periods of 10,000 years that must have elapsed during the accumulation of the immense mass of recent fresh-water strata said to exist in the valley of the Mississippi.

The calculation as to the latter is made from the *data* collected by observers in America, of the extent of the deposit in question; and it is here supposed, first, that in former periods the *same* quantity of mud as at present has been annually carried into the Gulf of Mexico; and secondly, that the amount of sediment deposited on the delta and plains of the Mississippi does not exceed *one-tenth part* of the solid material which has been carried out (suspended in the water of the river) into distant parts of the Gulf of Mexico, or into the Atlantic Ocean itself.

From recent accounts by Mr. C. Ellet, of the United States, it appears that a column of fresh water, 1¼ mile wide and about 7 feet deep, is constantly entering the Gulf of Mexico at a speed of 2 to 2½ miles per hour, and floats on the surface of a stratum of salt water, to which it partially communicates its own velocity. And below this a stratum of sea-water is found to be flowing in an opposite direction to that of the two strata of fresh and salt water above it.

From the data submitted, it would appear that the accumulation of the alluvial deposit of the Mississippi must have occupied a great number of periods, during each of which an elevation of the sea-level of 3 inches may have occurred.

The general conclusion arrived at is, that the sea-level cannot be considered as stationary for practical geological purposes, since the operation of present physical causes would produce a considerable change in its height, even during the construction of a recent deposit like that in the valley of the Mississippi, which may be called small and local compared with those older formations familiar to geological observers.

But the subsidence and elevation of the crust of the earth would be accompanied by alterations of the area of the sea-bed; and the frequency of such movements would therefore furnish additional reasons for not considering the sea-level permanent for the lengthened periods requisite for the accumulation of sedimentary deposits of any magnitude.

In the Third Part of this paper an attempt is made to direct attention to the difficulty of finding any test by which to distinguish strata gradually accumulated during a long-continued upward movement of the sea-level, from those strata formed on a sea-bottom slowly subsiding while the ocean-level was stationary. In either case no change of depth of water may have occurred of sufficient importance to cause the removal of the Mollusca inhabiting the locality, and therefore the discovery of *the same species of organic remains from top to bottom of a thick deposit* is not an absolute proof (as has been supposed†) that gradual subsidence has occurred during that particular formation; because the condition of equal depth of water during any deposit might be produced either by subsidence of the sea-bottom or elevation of the sea-level, or by both conjointly.

In discussing these questions, the writer has not assumed that during gradual subsidences or gradual elevations, greater denudations or depositions would occur than when the level of the land and sea-bottom was stationary; because it is not certain, either that during such gentle oscillations the forces that would produce denudation are sensibly diminished or increased, or that the rocks which are brought within the reach of denuding forces are necessarily more easily worn away than those which were previously exposed to the same influences.

PART I.

It has long been acknowledged that the quantity of detritus annually carried into the ocean from various sources must displace an equal volume of water, and thus tend to raise the level of the sea. Many years since it was estimated by an Italian that this change might amount to one foot in a thousand years. The general opinion on this subject has been, that the effects produced by the present supplies of detritus would be too minute to be perceptible, and on geological enquiries the ocean-level has been considered as permanent for all practical purposes.‡ I here propose to offer the evidence of present denudation in certain countries where careful observations have been made, in order to show, that if such rapid destruction of land occurs in most localities, then the operation of present physical causes must be amply sufficient to effect a

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* From the Philosophical Magazine for April, 1853.

† "In formations from a few hundred to a thousand feet and upwards in thickness, the whole of which does actually belong to the same geological age and is therefore characterized by the same fossils, most curious and important results may be sometimes deduced if the position or relative heights at which the groups of fossils are imbedded be noted; and this is a point usually neglected. For, thanks to the researches of Professor E. Forbes, the depth of water under which a collection of shells lived can now be approximately told; and thus the movement of the crust of the earth, while the strata including the shells were accumulating, can be inferred.

"For instance, if the bottom of a cliff, say 800 feet in height, a set of shells are buried which must have lived under water only 50 or 100 feet in depth, it is clear that the bottom of the sea must have sunk to have allowed of the deposition of the 700 feet of superincumbent submarine strata; subsequently the whole 800 feet must have been upraised." (Darwin.)

‡ Manfredi. See Lyell's Principles, edit. 1850, p. 270 and 542.

perceptible alteration in the sea-level in a moderate space of time.

The mere consideration of the number of cubic feet of detritus annually removed from any tract of land by its rivers, does not produce so striking an impression upon the mind as the statement of how much the *mean surface level* of the district in question would be reduced by such a removal. This information may be obtained by calculation from the published accounts of the quantity of mud annually abstracted from districts of known dimensions by their rivers. In this manner it is found that the Ganges would in about 1751 years, at its present annual rate, carry away from the land it drains (which is supposed to be about 400,000 square miles) as much detritus as would cover that area to the depth of one foot, as the following calculation will show:—

Thus, 27,870,400 (superficial feet in a mile) $\times$ 400,000 = 11,151,360,000,000, the number of superficial feet in the area of 400,000 square miles drained by the Ganges. The number of cubic feet of detritus discharged annually by that river is 6,368,677,400. (See Lyell's Principles.)

$\frac{6,368,677,400}{11,151,360,000,000} = \frac{1}{1751}$; consequently the reduction of the mean level of the Ganges district is $\frac{1}{1751}$ of a foot annually, or 1 foot in 1751 years.

6,368,677,400 cubic feet of mud discharged $\times$ 856 water to mud = 5,444,074,288,640 = the number of cubic feet of water annually discharged by the Ganges.

$\frac{5,444,074,288,640}{11,151,360,000,000}$ = about ½ a foot, so that the mean annual discharge of water is equal to about 6 inches of rain on the whole area of 400,000 square miles.

The Mississippi, on the other hand, would occupy 9000 years at its present annual rate in reducing to the amount of one foot the mean surface-level of the district it drains, which is computed at eleven hundred thousand square miles. The result is obtained as follows:

If 3,702,758,400 cubic feet of mud are annually carried down by the Mississippi (since the mud is to the water as 1 to 3000), 3,702,758,400 $\times$ 3000 = 11,108,275,200,000 = the number of cubic feet of water annually carried by the river into the Gulf of Mexico. The area of district drained by this river is stated at 1,100,000 square miles = 5280 $\times$ 5280 = 27,878,400 = the number of superficial feet in a mile—27,878,400 $\times$ 1,100,000 = 30,666,240,000,000 = the number of superficial feet contained in the area of 1,100,000 square miles drained solely by the Mississippi.

$\frac{11,108,275,200,000}{30,666,240,000,000}$ foot = ⅓ foot nearly. Consequently the water carried down by the river is equal to about 4 inches of rain over the surface of land drained.

If it be assumed that the levels of the rivers, lakes and springs are the same in this district at the same period of two consecutive years, the water sufficient to produce the above-mentioned 4 inches of the total of rain-fall upon the whole of this district must have been annually derived from clouds which have been charged with vapor in parts of the earth beyond the confines of the tract of country under consideration; since if the 4 inches of rain annually carried into the Gulf of Mexico were not replaced from foreign sources, the levels of the rivers, lakes, and springs must rapidly fall.

The estimate of denudation obtained from these countries may be incorrect when applied to other lands differing in altitude and receipt of rain. Besides, many rivers empty themselves into lakes and inland seas, and other extensive tracts are entirely without rain. Since there must be extensive districts which contribute no detritus whatever to rivers, I propose to *assume* that one half the earth's surface only is drained by rivers flowing directly into the sea,* and that the average supply of detritus does not exceed that afforded by the district through which the Mississippi flows (a country where there are no very high mountains, and only a moderate quantity of rain).

The quantity of soluble salts annually carried into the ocean must amount to a very large volume, particularly as river-water always contains matter in solution, while it is only during two or three months of the year that alluvium in suspension is carried down in large quantities. The proportion of soluble salts in the water of the Thames is 17 to 70,000, or 1 to 4117; while the proportion of alluvium suspended in the water of the Mississippi is as 1 to 3000.†

The level of the land is as much reduced by what is carried away in solution, as if this were mud and sand removed in suspension; and a submarine deposit formed from materials brought into the sea in solution will displace a volume of water equal to their former bulk; and therefore, when the annual supply of soluble salts to the ocean does not exceed the quantity separated from solution, the same effect will be produced upon the sea-level by matter introduced, whether it be in solution or suspension. While the proportion of the land to the ocean remains as 1 to 3,‡ it is evident that a reduction of 3 feet in the mean surface-level of the land must take place by denudation before a volume of detritus would be conveyed into the sea sufficient to displace enough water to occasion an elevation of one foot on the ocean-level.

There is great need of further information respecting the amount of sediment carried down by other rivers besides those mentioned; yet if the rate of denudation obtained from the statistics of the Ganges and Mississippi be any guide to what is occurring on the remainder of the globe, we cannot suppose that an indefinite time would be required for the performance of a denudation, which should reduce the mean surface-level of the land 3 feet and raise that of the ocean 1 foot. It was during the contemplation of the changes of level that might have been produced by the operations of ordinary physical agents upon the surface of the earth, that Hutton was led to remark that it was not necessary to suppose the area of the land always maintained the same extent, but that from time to time new land would be formed by the elevatory movements of the sea-bottom to compensate for what had been carried into

* By reference to Johnston's Physical Atlas, the calculated proportion of land drained by rivers running into European lakes and inland seas may be seen.

† For the statistics of the Mississippi River, see Sir Charles Lyell's Second Visit to the United States, edit. 1847, vol. ii, p. 249 to 253 and other places.

‡ M. Balbi shows (Atlas, Soc. Diff. Useful Knowledge. 1844) that the land on the globe equals 37,647,000 square geographical miles, the sea equals 110,875,000 square geographical miles.

the ocean by the continued operations of rivers and breakers * In speaking of the elevation of the sea-level, I only refer to the intervals between those movements of the land which might neutralize in an instant all that had been effected by the operation of rivers for immense periods of time.

It would add very much to the interest of this inquiry if any proof could be brought forward of a recent gradual upward movement of the sea-level. This would, however, be difficult to observe,† on account of the rise in the water concealing the evidence of its former level, except just at the mouths of rivers, where the deposits of fluviatile alluvium might raise the land from time to time and keep it always above the rising waters.

The deposits situated at a few such localities have been described by the best observers, and I hope to show that in several cases there are appearances which might be partly explained by changes of the sea-level, but that a much greater number of cases and more certain evidence would be needed before such an event could be satisfactorily proved. I propose to make some remarks upon this point, after having submitted the evidence which has induced me to believe that the supply of detritus under present physical conditions is sufficient to raise the ocean level 3 or 4 inches in 10,000 years, provided no subsidence or elevation disturbed the result.

To this subject I now proceed. Sir Charles Lyell's published statements of the quantity of mud annually carried down by the Mississippi and Ganges appear to have been made with so much care, that they may be a better guide to the general rate of removal of soil by rivers than information obtained from a greater number of smaller rivers, which of course are more likely to be influenced by local circumstances. Eleven hundred thousand square miles of land are drained by the Mississippi,‡ which annually discharges a quantity of water equal in volume to 4 inches of rain or about one tenth of the total rain-fall over this entire surface, which forms one-fifth part of North America.§ From the mean of a great number of observations, the average quantity of alluvium suspended in the water appears to be 1 part in 3000. Consequently, as the water annually drawn off would cover an area of eleven hundred thousand square miles to the depth of four inches, the quantity of mud removed in the water, as measured at or near the mouth of the river) would cover the same extensive surface to the depth of 1-3000th part of four inches, or to the depth of 1-9000th part of a foot. Or, in other words, the Mississippi at its present rate would occupy 9000 years in carrying away detritus before the mean surface level of one-fifth part of North America would be reduced one foot.

The Ganges discharges into the Indian Ocean a supply of water equal to about six inches of rain on 400,000 square miles, or a much greater volume of water than the Mississippi pours into the Gulf of Mexico, taking into consideration the difference in size of the countries they drain.

The alluvium suspended in the waters of the Ganges is as 1 to 858 by weight; consequently the detrital matter removed in suspension by the water in one year would cover the land from which it is derived to the depth of 1-1751 of a foot; that is to say, the Ganges might pour out muddy water at its present rate for 1751 years before the mean level of 400,000 square miles would be reduced one foot in height. The great elevation of the Himalaya range, or possibly a greater rain-fall, may probably occasion the difference between the rates of denudation indicated by the Ganges and the Mississippi. As there are also parts of the earth's surface drained by rivers flowing into lakes and inland seas, and other tracts are entirely without rain, I propose to estimate (as before mentioned) that only half the land contributes detritus in suspension to rivers flowing directly into the sea.|| If this area be annually reduced in level at the same rate as the district through which the Mississippi flows, then the mean level of the land on the globe, would be reduced 3 feet in 54,000 years, and consequently the level of the ocean raised 1 foot in the same period by means of the detritus suspended in river-water poured into the ocean.¶

But in addition to the sediment carried down by means of rivers, we have also to take into consideration the amount of debris washed into the sea from cliffs during so long a period as that mentioned. It is difficult, however, to form any estimate of what this would annually amount to, for old maps and charts are hardly accurate enough to represent the waste of cliffs by breaker-action even within the last 100 years. Capt. Washington has, however, published a report** which gives an account of the encroachment of the sea at intervals on one part of the Suffolk coast. This will give a general idea of the contribution of detritus that may be obtained from some points of a coast-line. The following statements are collected from Capt. Washington's Report on Harwich Harbor in 1844.

The cliff on the western side of the harbor is about 1 mile long and 40 feet high, and the encroachment of the sea appears to have been at the rate of 1 foot per annum between the years 1709 and 1756, so that the annual supply of detritus was equal to 40 cubic feet for each foot of frontage. Between 1756 and 1804 the advance increased to nearly 2 feet per annum; so that the annual removal of cliff amounted to nearly 80 cubic feet for each foot of frontage.

Between 1804 and 1844 the encroachment of the sea averaged 10 feet per annum, and the annual removal of detritus must have amounted to 400 cubic feet for each foot of frontage. It was during this latter period that extensive dredging for cement stone took place at the base of the cliff.

On the eastern side of the harbor events of an opposite character have occurred, for Landguard Point has gained 50 feet per annum in length during the last 30 years. The addition thus made to the land, and to the "littoral zone," presents an interesting example of the rapid accumulation of a local deposit under favourable circumstances. From the appearance

* "It is not necessary that the present land should be worn away and wasted exactly in proportion as new land shall appear; or conversely, that an equal proportion of new land should be produced as the old is made to disappear." (Hutton's Theory of the Earth, 1795, vol. i, p. 196.)

† See Darwin, Coral Reefs, &c. edit. 1851, p. 95.

‡ See art. Mississippi, Penny Cyclopædia, vol. xxv, p. 277.

§ The total rain-fall of the United States is 39 inches between $24\frac{1}{2}°$ and 45° N. lat. (Berghaus and Johnston.)

|| The proportion of land without rain is about 1-1200th of the whole. Keith and Johnston say that nearly one half the drainage-water of Europe and Asia falls into the Black and Caspian Seas. The proportion for Africa and America is not known.

¶ It is not improbable that the *solvent* powers of rain and river-water are as important agents in the removal of land as the agency above mentioned. Definite calculations on this subject remain to be made.

** Tidal Harbors' Commission, First Report of 1845.

of the beach, it would appear that the shingle and sand of which it is formed have been brought from the north, in which direction there are recorded instances of great destruction of land by storms during the last 300 years. The aspect, however, of much of the coast-line appears as if it had remained unaltered for a very long period, except in the manner Mr. R. A. C. Austen* alludes to when he remarks "that although the sea for months together, and in places even for whole years, may not acquire any fresh spoil, yet there are few hours when its waters are unemployed in fashioning and abraiding the materials already acquired." In considering the effect upon the sea-level caused by sand, mud, and pebbles washed in by the breakers, it is only necessary to regard those materials that may be brought in from cliffs above high-water mark; for the movement of sand and mud below high-water mark can produce no effect upon the sea-level, because the abstraction of these materials from one part of the shore is exactly balanced by their addition to some other part. For instance, some of the flint-pebbles which have contributed to the recent deposit at Landguard Point have been brought along shore a great distance from their original position on the cliff. These flints formed an addition to the sea-bed, and tended to raise its general level by displacing an amount of water equal to their bulk the moment they fell on the shore below high-water mark; and it is quite clear their subsequent movements, either beneath the wave or on the beach, could produce no further effect upon the sea-level, the spaces they occupied on one part of the coast being balanced by the vacancy left at some other. It is also evident that the beach at Landguard Point will go on extending so long as the fresh supplies of shingle and sand from the north exceed the removals southward.

In the same manner the continued supplies of pebbles from the westward enables the Chesil Bank to preserve its position. As soon, however, as any disturbing causes interrupt the supplies of new material, the sand and shingle beaches dependent upon them must soon disappear; and in fact the termination of every beach will be at that point where the waste and abrasion by breaker-action are balanced by the supply of pebbles and sand drifted from other places. Although it appears clear that only the detritus obtained from cliffs above high-water mark need be taken into calculation, yet I regret to find that scarcely any data of this kind exist, and therefore it is not possible to ascertain the probable effect upon the sea-level that is being produced by the detritus so derived. In the same manner the per-centage of soluble salts in the water of the few large rivers of which notes have been published has not been given separately from the per-centage of matter in suspension, and therefore we are in ignorance of the supplies that are annually introduced into the ocean from the formation of submarine deposits from materials dissolved in the sea-water. When the rise in the sea-level from the effect of alluvium brought in suspension by rivers was being considered, I supposed that that cause alone might produce an elevation of one foot in 54,000 years; but in order to make some allowance for the similar effects that must be produced by the introduction into the ocean of materials from above high-water mark on coast lines† by breaker-action, and also by the formation of submarine deposits from materials which were brought into the ocean in solution, I now propose to consider that all these causes together might produce an elevation of the sea-level equal to one foot in 40,000 years, or three inches in 10,000 years.

Mr. Darwin has remarked, that "the knowledge of any result, which, with sufficient time allowed, can be produced by causes, though appearing infinitely improbable, is valuable to the geologist, for he by his creed deals with centuries and thousands of years as others do with minutes." For these reasons even if, upon further investigation, it should be found that the true rise in the sea-level is much less than three inches in 10,000 years (in periods undisturbed by subsidences and elevation,) yet it may still be an important element in accounting for those changes which we are now about to consider.

* Austen, Quart. Jour. Geol. Soc. vol. vi. 71-73. and De la Beche, Geol. Observer, 1851, p. 65.

† The rough estimation of the extent of coast-line, kindly supplied by Mr. A. K. Johnston, (Nov. 1852,) is as follows:—

	Nautical miles (60 to a degree.)	English statute miles (69½ to a degree.)
Europe, - -	17,200	20,425
Asia, - - -	30,800	34,825
Africa, - -	14,000	16,625
America, - -	37,600	44,656
	99,600	116,531

(*To be continued.*)

New York Industrial Exhibition.

SPECIAL REPORT OF MR. DILKE, PRESENTED TO THE HOUSE OF COMMONS BY COMMAND OF HER MAJESTY, IN PURSUANCE OF THEIR ADDRESS OF FEBRUARY 6, 1854.

Mr. Dilke's sudden recall to England while collecting information connected with the New York Industrial Exhibition, prevented him from giving more than a passing attention to the details of the subject. To Mr. Antrobus Holwell, the Commissioner from Canada, the public are indebted for the Reports on the Classes which comprehended Naval Architecture, Military Engineering, Ordnance, Armour and Accoutrements, Philosophical Instruments and products resulting from their use. (*e. g.* Daguerreotypes, &c.,) Maps and Charts, Horology, Surgical Instruments and Appliances. Indeed we may justly say that Mr. Dilke's report is not a report of the Exhibition, it is merely a collection of official details and notices of facts, without any special bearing upon the subject he was sent to investigate. The supply of water to towns,—Limited Partnerships—Industrial Educational Establishments—the Smithsonian Institution—and Fire Establishments—are briefly alluded to, and some interesting, although to a Canadian scarcely novel, descriptions are given and facts recorded. The readers of the *Canadian Journal* are already familiar with the description of the building in which the American Exhibition was held (see *Canadian Journal*, Vol. I., page 69). The same description together with a similar plate of the building is given in Mr. Dilke's Report. The objects exhibited were divided into thirty-one classes; Mr. Dilke furnishes a report on two of these classes only—class 8, and 10. The report on these classes was written by the Canadian Commissioner, and it bears the title of—"Notes on some of the Contributions to the Exhibition of the Industry of all nations at New York, in 1853 by W. Antrobus Holwell, Ordnance Store Keeper, Quebec, and Commissioner from Canada"—we proceed to extract a few interesting items.

Breech-loading and Self-cleaning Rifles; Shot-Guns, and Pistols.

Marston Fire Arms Manufacturing Company, New York.—That this is a favourite description of rifle with the Americans may be inferred from the fact, that the number of men employed in January 1853 in the manufacture of these and other similar arms and cartridges of Mr. Marston's invention was but ninety, and has been increased to upwards of a hundred and forty; the average sale being at the present date (December 1853) about forty a week. The breech-

loading part of the invention consists in a sliding breech pin, which is drawn back in a line with the bore by means of a lever, the handle of which is below the butt; thus exposing a longitudinal opening in the right side of the piece immediately behind the breech end of the barrel: into this opening the cartridge is placed, when by drawing back the handle of the lever the breech pin is thrust forward, pushing before it the cartridge, which is thus logded within the barrel; the interior and shorter end of the lever is of solid metal, and is so placed with respect to the breech pin as that when the latter is pushed wholly forward it forms with the solid end of the lever a substantial joint, the longitudinal axes of the two pieces lying at an angle of about 135° to each other. Great strength in resisting the force of the discharge is claimed for this arrangement, in consequence of the combination of these two pieces of metal being *somewhat* similar to the "key-stone of an arch;" it must, however, be rememembered that the whole force of the recoil is borne by the pivot on which the lever (representing the "key-stone") *turns*, there being little or no provision (in the arms examined) for relieving this pivot from the whole of this strain (though it is conceived that an arrangement for that purpose might easily be effected by strengthening the lower part of the recess in which the lever moves and causing the lever to bear against it). A small hole is bored through the sliding pin in such direction as to effect the necessary communication between the vent and the cartridge when the breech pin is pushed forward; the cartridge consists of a paper cylindrical shell cemented or tied to a small cylindrical projection at the base of the bullet, which is conical; the shell being filled with powder is closed by a disc of leather cut to fit *tightly* the bore of the piece, and greased round its edge. A small hole is bored in the centre of this disc to admit of the necessary communication between the priming and the powder in the cartridge. At each discharge the last disc of leather *remains in the barrel* and is forced forward by the introduction of the next cartridge, and subsequently blown out by its discharge; it thus *cleans out* the barrel, which *it is said* will in consequence be left "perfectly *bright* after a *thousand* discharges." Their price varies from $25 to $100.

New Revolving Guns and Pistols.

P. W. Porter, Inventor, Memphis, Tennessee.—A solid steel cylinder or disc ($2\frac{1}{2}$ inches in diameter, and about $\frac{3}{4}$ths of an inch thick) has its periphery bored with eight or nine cylindrical chambers radiating towards the centre; each chamber being of just sufficient depth to receive a small cartridge with its ball. As this cylinder is made to revolve in a recess immediately behind the breech, each chamber in the cylindrical disc corresponds with the bore of the barrel, and each chamber has a perforation or channel leading from its inner or rear end to the exterior (right) face of the revolving disc, where it is covered by the cap or primer *only* when the chamber with which it communicates is in a line with and opens into the bore of the barrel; the lock moves backward on a hinge which allows it to close upon the side of the cylinder when in use, or to be opened out whenever it might be necesssary to charge or exchange the cylinder; the hammer is in the *interior* of the lock which is of simple yet effective construction; the cylinder is turned round (so as to bring each chamber successively in position) by the motion of a lever (which forms also the trigger guard) downwards and forwards with the left hand; the hammer is cocked by the same movement, so that in firing all that is necessary is for the left hand to move the lever, and the right to pull the trigger. A very rapid succession of discharges may be thus obtained (as many, it is *said*, as forty in a minute, including the exchange of cylinders), an advantage which this rifle probably possesses in a higher degree than any other known contrivance.

Sharp's Patent Primer attached to a Shot-Gun.

C. Sharp, inventor, and manufacturer, Hartford, Connecticut.—This is an ingenious invention, and promises to become a favourite, although from its recent origin it has not yet had the advantage of extensive trial. The percussion primers consist of very small discs or "pellets" of copper (probably not more than three-sixteenths of an inch in diameter), fifty of which are contained in a small receptacle in front of the lock and beneath the head of the hammer. These "pellets" are said to be "*air and waterproof.*" The piece being cocked, the trigger is pulled, and although no indication whatever of any cap or other priming is visible, an explosion is heard each time the hammer descends; but by slowly letting down the hammer, one of these minute discs containing the priming is seen to emerge from a scarcely perceptible hole in the lock, immediately beneath the head of the hammer, being thrust out with a sort of jerk by means of a slender bolt or sliding piece, which exactly fits the slit, and which having ejected the disc immediately returns to be ready to force out another at the moment of the hammer's descent. The little disc is thus deposited, *as if by magic*, immediately over the nipple, where it is *immediately* struck by the hammer, the end of which has a slightly conical cavity for its reception, and so unerring and certain is this jerking of the disc into its proper position, that whether the piece be held with the hammer uppermost, as in the ordinary way of firing, or reversed, or with the muzzle pointing upwards or downwards, or in short, in any conceivable position, the effect is always equally satisfactory.

Mr. Sharp also exhibits his *Breech-loading Rifle* (patented in 1850). By some accident or oversight it is not mentioned in the catalogue, This rifle may probably with safety be pronounced as, all things considered, the best breech-loading *single charge* fire-arm yet invented; and in proof that it is generally so esteemed, it may be mentioned that, since it was patented in 1850, upwards of 40,000 have been manufactured and sold; and further, that the United States Government, have, upon the recommendation of a Board of Ordnance Officers, held in November, 1850, ordered a trial of them to be made by the army on active service. The Board in question, after a severe trial of this rifle, report that "it was fired several hundred times without cleaning, during which the movements of its machinery were not obstructed:" and also that "the penetration, range, and accuracy of its fire with the cartridges and conical ball prepared for it, were superior to those of any other breech-loading piece offered to the Board.

Its construction is simple. A solid breech-piece of about three-quarters of an inch in thickness, is inserted in a recess immediately behind the chamber of the barrel, so as that the faces of such breech piece shall slide against and completely close the same. This piece is drawn downwards by moving forward a jointed lever, which forms also the trigger guard; the bore of the barrel is thereby completely exposed, and may be *looked through*, thus affording great facility for observing whether it is clean or foul. The cartridge with its ball attached is then inserted by hand into the bore, and pressed home with the thumb. The lever, or trigger guard, is then brought back, which raises the breech piece, the front upper edge of which being *sharp*, cuts off the end of the cartridge so as to completely expose the powder within it to the action of the priming, which may either be the common percussion cap, "Maynard's" primer, or Mr. Sharp's own ingenious "pellet," above mentioned. The cartridge prepared expressly for this gun is provided with a conical bullet, but any description of cartridge may be used, or even loose powder, by first forcing forward the ball to the proper depth by means of a suitable rammer, and then carefully pouring over it the requisite charge of powder, any excess of which will be removed by the return of the breech piece. For safety and precision of firing and for simplicity of construction, this appears undoubtedly superior to all other breech loading single charge guns.

The prices of Mr. Sharp's Rifles are as follow:

Carbine, Plain Octagon	$35
Do. with Globe Sight	45
Do. Ornamented from	$60 to 100

J. H. Fitzgibbon, of St. Louis, Missouri, exhibits a large miscellaneous collection of Daguerreotypes. Many of the pictures are well executed. He also exhibits four *Electrotype Copper Copies* of *Daguerreotypes*, together with the originals from which they were taken. The appearance of the copper duplicates is decidedly superior, in tone and general effect, to that of the original pictures; they have also the advantage of not being reversed: it is much to be regretted that this simple and very successful process is not more generally adopted by Daguerreotypists. These are the only specimens in the Exhibition.

Miscellaneous Philosophical Processes or Products.

Specimens of Electrotype Copperplates, produced at the United States Coast Survey Office.—These plates are three in number, and consist of,—1st. The original engraved plate; 2nd. A reverse or Matrix obtained therefrom by electro deposit; and 3rd. A "Duplicate" or fac-simile of the first or original plate, this last being also obtained by electro deposit upon the reverse or matrix No. 2; a printed proof or impression on paper from this latter completes the collection, and affords satisfactory evidence of the perfect manner of conducting the whole operation, all the most minute points and delicate lines being brought out beautifully sharp and distinct. As the several

processes adopted in the production of these plates appear to be all of the most improved description founded on sound philosophical principles, whilst some of them are claimed as the invention of Mr. Mathiot, of the Coast Survey Electrotype Laboratory, under whose able direction the whole work is conducted, a brief description of those processes may not be unacceptable.*

The original plate as received from the engraver, is immediately electro-silvered, and then washed with an alcoholic solution of iodine and exposed to sunshine or bright light. This is found effectually to prevent the adhesion of the electro deposit to the original plate (probably by the interposition of an infinitesimal film of the *vapor* of iodine), without in the slightest degree imparing the sharpness of the impression, the thickness of the coating of iodine vapour being estimated by Mr. Mathiot at *one forty-four millionth* part of an inch: or, upon the supposition that the iodine remains upon the plate in its elementary state then the thickness of the deposit is estimated at the "*one eighteen thousand millionth* part of an inch!"

The plate thus idoized is placed in the vat or decomposition trough in a *vertical* position (the necessary connections with the battery and other arrangements being effected, as usual), and as soon as a sufficient surface layer is produced which usually takes about twelve hours), the plate with its surface layer is removed to another vat, in which it is placed horizontally with its face upwards, and the positive pole or plate of copper immediately over it, at a distance of about an inch, —the temperature of the copper solution in this horizontal bath being maintained uniformly day and night at about 180°. This is effected by means of a simple furnace with self-regulating damper and an internal coil or helix of pipe, with an upper and a lower tube leading to the corresponding parts of the vat or bath, in which the required temperature is thus maintained by the circulation of the fluid in the ordinary manner; it being found that a peck of charcoal will maintain 100 gallons of the copper solution at any required point between 100° and 200° for twelve hours; the result of such increase of temperaturo being that a plate of copper one-eighth of an inch thick, and containing 10 square feet of surface, can be produced in forty-eight hours, or at the rate of 3 lbs. to the square foot in twenty-four hours. The quality of the metal produced under such increased temperature being moreover found to be of a very superior description, rivalling in hardness ductility, and elasticity the best rolled or hammered copperplate. This is satisfactorily exemplified in a couple of broad strips of copper, one-eighth of an inch thick, which are exhibited near these plates. One of the strips is flat, and found to be exceedingly hard and sonorous; the other is twisted up into a sort of open single knot, to prove the perfect ductility and tenacity of the metal. It may also be mentioned that about 2,000 impressions were printed from the first electrotype duplicate taken from the original plate in the Exhibition without its showing any appearance of deterioration, although the lines are many of them exceedingly light and delicate,—so much so, that it is said by competent judges that the original *engraved* plate would probably have failed in producing *one* thousand equally good impressions.

Mr. Mathiot manufactures or produces the negative silver plates of his batteries by electro deposition, and in order to remove from their platinized surfaces the impurities of the zinc plates, which are invariably found to attach themselves thereto, he immerses them *daily* in a solution of per-chloride of iron, which is found to immediately restore the action of the plate, and thus constantly maintain the "*tone*" of the battery.

Mr. Dilke's account of the Smithsonian Institution contains much interesting information which will be read with pleasure by all, although it may not possess the charm of novelty to many of our readers, who are familiar with the progress of this valuable Institution, through its published records and the frequent references made to it in American Scientific and Literary Periodicals. We subjoin a few extracts.

The Smithsonian Institution.

This magnificent establishment, founded at Washington out of funds bequeathed for that purpose by an English gentleman, is exercising so much influence throughout the United States, and I may also say throughout the world, that I feel bound to give some account of it, and also of its course of action. Mr. Hugh Smithson, one of the family of the present Duke of Northumberland, died at Genoa, on the 27th of June, 1829, leaving a fortune of about £120,000. By his will he desired that the income arising therefrom should be paid to his nephew, H. G. Hungerford, during his life, and that the property itself should descend to his children, if he had any, absolutely; but the will went on to say—

"In case of the death of my said nephew without leaving a child, or children, or of the death of the child or children he may have had, under the age of 21 years, or intestate, I then bequeath the whole of my property (subject to an annunity of 100 pounds to John Fitall, and for the security and payment of which, I mean stock to remain in this country) to the United States of America, to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men."

The circumstances of this bequest are somewhat remarkable. Nothing is known of the reasons which induced the testator to select a city in the United States for the site of the proposed Institution. He had never been, it is believed, in America, and is supposed to have had no predilection for republican forms of Government; nor does it appear, from anything found among his book and papers, or from the recollections of his associates, that he had ever taken a special interest in the people of the United States. In June, 1835, Mr. Hungerford died without issue, and in July, 1836, a bill was passed by Congress to empower the President of the United States to appoint a special Agent who should act in England, and receive the amount thus become due to the United States' Government.

In September 1838 the money, $515,169, was paid over by the English Court of Chancery to the Hon. Richard Rush, the agent appointed by the Government of the United States; and eight years after, on the 10th of August, 1846, an Act was passed for the purpose of establishing the Smithsonian Institution.

"This Act creates an establishment to be called the Smithsonian Institution, composed of the President and Vice-President of the United States, the Secretaries of State, of the Treasury of War, and the Navy, the Postmaster-General, Attorney-General, and Mayor of Washington, with such others as they may elect Honorary Members. It devolves the immediate government of the Institution upon a Board of Regents, of fifteen members; namely, the Vice-President of the United States, the Chief Justice of the Supreme Court, and the Mayor of the city of Washington, *ex officio*, three members of the Senate to be appointed by the President thereof, three members of the House to be appointed by the Speaker, and six persons to be chosen from the citizens at large, by joint resolution of the Senate and House, two of whom shall be members of the National Institute, and the other four inhabitants of States, and no two from the same state.

"The Act also establishes a permanent loan of the original fund ($515,169) to the United States at six per cent. interest; appropriated the accumulated interest, then amounting to $242,129, or so much as might be needed, together with so much of the accruing income as might be unexpended in any year, for the erection of a building; provided for the establishment of a Library, Museum, Chemical Laboratory, &c., and left most of the details of the organization to the Board of Regents."

The very general terms of the bequest gave rise to difficulties as to the best mode of carrying the wishes of the testator into effect; but the Board of Regents having in the outset been fortunate enough to secure the services of Joseph Henry, L.L.D., of Princeton College as Secretary and Chief Executive Officer of the Institution, they empowered him to draw up a programme of organization, which was adopted by the Regents in 1847, and as the principal points in this programme are given in Professor Henry's Report to the Board, dated 1st of January, 1851, I have thought it better to quote a few passages.

"Smithson left his property, in case of the death of his nephew, to whom it was first bequeathed, 'to found at Washington under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men.' These are the only words of the testator to serve as a guide to the adoption of a plan for the execution of his benevolent design. They are found, however, when attentively considered, to admit of legitimate deductions sufficiently definite and comprehensive.

"1. The bequest is made to the United States, in trust for the good of *mankind*.

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* See *Canadian Journal*, Vol. I., p 226, for a full report of this process.

"2. The objects of the Institution are two-fold: first, to increase, second, to diffuse knowledge; objects which, though often confounded with each other, are logically distinct, and ought to be separately regarded. The first is the enlargement of the existing stock of knowledge by the discovery of new truths, and the second is the dissemination of these and other truths among men.

"3. No particular kind of knowledge is designated, hence a liberal interpretation of the bequest will exclude no part of the great domain of science and literature from the degree of attention its importance may demand.

"4. Since mankind are to be benefited by the bequest, any unnecessary expenditure on merely local objects would not be in accordance with the proper administration of the trust.

"5. Though the funds are generally considered large, and much is expected of them, they are really small in proportion to the demands made upon them. The annual income of the bequest is less than half the cost of the publication of a single yearly report of the Patent Office.

"6. In order, therefore, that the limited income may effect the greatest amount of good, it should be expended in doing that which cannot be done as well by other means.

This sum of 150,000 dollars having been subsequently added to the original 515,169 dollars, the Smithsonian Institution has now a permanent fund of 665,169 dollars, which, at the rate of interest allowed by the Government, yields an annual income of about £8,000.

The rules now adopted in reference to the distribution of the Publications issued by the Institution, are very liberal.

"1. They are to be presented to all learned Societies which publish transactions and give copies of these in exchange to the Institution.

"2. Also, to all Foreign Libraries of the first class, provided they give in exchange their catalogues, or other publications, or an equivalent from their duplicate volumes.

"3. To all Colleges in actual operation in this country; provided they furnish in return, meterological observations, catalogues of their Libraries and of their students, and all other publications issued by them, relative to their organization and history.

"4. To all States and Territories; provided they give in return copies of all documents published under their authority.

"5. To all incorporated Public Libraries in this country, not included in either of the foregoing classes, now containing more than seven thousand volumes, and to smaller Libraries, where a whole State or large district would be otherwise left unsupplied.

"The author of each memoir receives, as his only compensation, a certain number of copies of it, to distribute among his friends, or to present to individuals who may be occupied in the same line of research. In this way single memoirs are distributed to individuals, and especially to those who are most actively engaged in promoting discoveries. Copies of the reports, and also in some cases, of particular memoirs, are sent to all meteorological observers. Besides these, we have placed on the list the more prominent Academies and Lyceums, as recipients of the minor publications. It is also intended, in order to benefit the public more generally, to place on sale copies of memoirs and reports, though on account of the number required for the supply of Institutions, we have not as yet been able to carry this plan into effect.

"No copyright has been taken for the Smithsonian publications; they are therefore free to be used by the compilers of books, and in this way they are beginning to reach the general reader and to produce a beneficial effect on the public mind."

It is mentioned in Professor Henry's Report for 1852, that the number of copies of the "Smithsonian Contributions" distributed is greater than that of the transactions of any other Scientific or Literary Society.

The Regents of the Institution being of opinion that the rapid interchange of literary and scientific publications is of the utmost importance for the developement of knowledge, have constituted themselves the medium for such intercommunications between all Public Scientific and Literary Societies of the Old and New World. For this purpose all important scientific documents issued by the Governments, by the Public Learned and Scientific bodies in the United States, are collected at Washington, and then dispatched to their agents in London, Paris, and Leipsic for distribution; and the agents at the above named places forward to the United States all documents received in exchange; the Smithsonian Institution taking upon itself all cost of transport, so that no delay may be experienced in the receipt of the communications in America. The extent to which this system has been carried, is, I suspect, little known in this country, but may be inferred from the following abstract of the number of Societies in communication with the Institution, and for which parcels are collected.

3	Public	Bodies in	Africa	9	Public	Bodies in	America (South)
10	"	"	Asia	7	"	"	Belgium
4	"	"	Denmark	84	"	"	Great Britain & Ireland
54	"	"	France	69	"	"	Germany
1	"	"	Greece	10	"	"	Holland
1	"	"	Iceland	25	"	"	Italy
4	"	"	Norway	1	"	"	Portugal
12	"	"	Russia	5	"	"	Sweden
4	"	"	Spain	9	"	"	Switzerland
1	"	"	Turkey				

We conclude our Extracts from Mr. Dilke's Report with an account of a Steam Fire Engine lately built at Cincinnati:

Cincinnati Steam Fire-Engine.

This engine, which cost rather more than two thousand pounds, and weighs between five and six tons, throws eighty-four thousand gallons in an hour. Five horses are required, four to draw the engine, and one the fuel and reel cart. Mr. Dilke and Professor Wilson went to see the engine. Mr. Dilke says—"On reaching the station we satisfied ourselves that there was no fire in the engine, and that the water in the boiler was cold. On the order being given to proceed to a particular point, the light was applied to the grate, always kept ready filled with very combustible materials, the horses were harnessed, and the engine left the house in 3½ minutes after the supposed fire was announced. It reached the spot indicated, 1,450 feet distant from the engine-house, in 2¾ minutes, and in 6½ minutes from the first announcement the horses were uncoupled and the engine placed over the supply cistern. In 8½ minutes the steam-guage was at 35°, and the pumps self-feeding. In 9 minutes a hose was affixed, and the reel despatched in 9½ minutes to about 100 feet distant from the engine, during which time a second hose was being fixed and laid out. In 12 minutes water was issuing from one hose, and in 12½ minutes from both. In 13 minutes the jet of water reached 100 feet from the nozzle first applied, one of an inch diameter, and from that time a large body of water was pouring forth. In 17 minutes the supply was strong enough to rise about 60 feet in height. In 28 minutes it was playing over a moderate-sized house. In 33 minutes all six nozzles were in use. In 38 minutes the issue of water was stopped, that the capability of supplying steam jets might be shown. In 39½ minutes a very powerful blast of steam was issuing. We were informed that the engine had on two or three occasions played six hours continuously, and once 12 hours, and we were given to understand that it had thrown water 230 feet—a statement we could believe from the power exhibited, and which was shown by directing the stream against a heavy cart standing empty in the street, and which was driven by it nearly 100 feet."

Statistics of Fibrous Materials.

The quantity of fibrous substances of all kinds imported into the United Kingdom last year was 614,000 tons; and deducting 72,000 tons exported, there remained for home consumption 542,000 tons. Of this quantity 94,000 tons were flax, and 63,000 tons hemp; and of these two articles 64,000 tons of flax and 42,000 tons of hemp, together 106,000 tons, came from Russia. The amount of paper manufactured in the five years from 1830 to 1834, both inclusive, was 354,940,658lbs, or an average of 70,988,131lbs.; and in the five years from 1849 to 1853 the manufacture increased to 756,170,193lbs., being an average of 151,234,178lbs. per annum. Last year the amount manufactured, in round numbers, was 177,000,000lbs., against 154,000,000lbs. in the previous year, showing an increase of above 23,000,000lbs. in one year.

The total quantity of flax imported in the whole term of fifty-three years, was 2,252,422 tons; of which Russia furnished 1,587,395 tons, and the rest of the world (all foreign) 665,027 tons. Of hemp, the

total importation was 1,829,291 tons; of which Russia furnished 1,505,189 tons; and the rest of the world, including India, 324,102 tons.

We have received from Russia, in the last 53 years, the following quantities and value of flax and hemp; the valuation being made, for the whole term of years, at the moderate rate of £40 per ton for flax, and £35 per ton for hemp;—

Of flax	1,587,395	tons	worth	£63,495,800
Of hemp	1,505,189	,,	,,	52,681,615
Together	3,092.584	,,	,,	£116,177,415

The importation of rags of every description, in the last 53 years, was 346,554 tons, or an average for the whole term of 6,539 tons per annum. We exported in the same period, 12,296 tons, of which 10,-146 tons were British and Irish rags; and only 2,150 tons foreign rags re-exported; and of the quantities so exported, 4,206 tons, or about 35 per cent. of the whole quantity in 53 years, was exported in the last two years, almost wholly to the United States.—J. B. Sharp, *Jour. Soc. Arts.*

Collossal Monument to Shakspere.

It is a subject of frequent remark by foreigners that there is in this country no monument to Shakspere. Siguor Chardigni has conceived the idea of erecting a gigantic statue of the great dramatist. Russia, he says, boasts her colossal statue of Peter the Great; Italy of Charles Borromeo; Bavaria its gigantic statue, the head of which forms a conspicuous ornament at the Crystal Palace. Why should not England have her great statue, Signor Chardigni proposes that the statue should be a hundred feet high, of cast-iron, formed by a new process which he has invented.

In the statue it is proposed to have three floors, with a staircase for ascending to the top or head of the monument. These three floors will divide the statue into three rooms, of about 80 feet in circumference and 15 feet each in height, the sides of which the artist proposes should be adorned with bassi-relievi, in cast-iron, representing all the chief scenes of Shakspere's plays. In the middle of the first floor are to be statues, in cast-iron, of the Queen and Prince Albert.

The third floor of the statue reaching to the head, will afford a most splendid panoramic view of London, through the apertures for the eyes, which, following the proportions of the rest of the statue, will be more than two feet wide. In addition to the light which will come from the apertures of the eyes, a large quantity of light will be admitted by the top of the head, which is for this purpose intended to be made of glass. In addition to this, the folds of the drapery of the statue will admit a variety of openings, not visible from below, through which light and air may be introduced. It is also proposed it should contain a library of the best editions of Shakspere's works.

Busts, in cast-iron, of contemporaries of Shakspere, and of those whose names have been worthily associated with his, would be fitting ornaments of the interior.

The statue would stand on a pedestal of stone, in which should be the entrance, through doors of cast-iron, whose panels might be adorned with appropriate bassi-relievi.

It has been suggested that the Regent's-park, or the top of Primrose-hill, are fitting spots for its erection,

On Modern Discoveries by the Microscope.

By T. Rymer Jones, F. R. S., Professor of Comparative Anatomy, King's College, London.

It is easy for any one to expatiate generally concerning the extent of the animal creation, and the limitless beneficence of Providence, but it is the microscopist only, who, reversing the Galilean tube, explores for himself the deep abysses of a drop of water, and finds therein a world invisible to the unassisted sense, feelingly can appreciate the works of the Almighty.

Not many years ago it was related that the inhabitants of a certain district in Sweden, possessing but a scanty stock of corn, were in the habit of mixing with their meal a portion of the earth of the country to supply the deficiency, and that this earth was found to be nutritious. Now it had long been an acknowledged fact that animal life cannot be sustained by inorganic matter; but how, then, in this case, could such be employed as nutriment? Many microscopes were speedily directed to this inquiry, and on examination, to the astonishment of an admiring world, this earth was found to consist of shells of microscopic creatures, shells as perfect in their construction as they were varied in their beauty. Such a circumstance as this was eminently calculated to attract the attention of the curious, and subsequent investigations were not long in proving the startling fact that whole tracts of country in different parts of the world—nay, solid rocks are altogether formed of similar materials. A coin shows by the impress upon it the name and date of the sovereign in whose reign it was issued, so do these "medals of creation" bear testimony to the eternal power and sovereignty of the Great Ruler of the world. Nearly 6000 years passed away before the invention of the microscope. Poetry had sought to pourtray the "flammantia mœnia mundi,"—it remained for the microscope to bring them before our view. Looking with the ordinary powers of the microscope into a drop of water, we perceive minute globes rolling round and round, having within them smaller globules revolving like satellites, not around, but within their parent planet. Multitudes of various forms have been found; and Ehrenberg, who had given much time and profound attention to the examination of these forms of being, has supposed them to be possessed of numerous stomachs, an eye, and a system of blood-vessels; but sober reflection and more recent investigation have assured us that these do not exist. The interior globules, supposed by him to be stomachs, at the touch of the magic wand of a sister science, have revealed their real nature: tested by iodine, they have shown themselves to be starch granules; and these infusoria, so long claimed as part of the animal creation, are now given up to the botanist as belonging to the vegetable world.

In his younger days he was told of a mill to grind old people young again, and laughed heartily at so absurd a story, little thinking that a greater number of years, more knowledge and mature reflection, would convince him of the truth of the tale as regards these infusoria, in whom division is multiplication; looking at one of these you will perceive a transparent line crossing it; sometimes longitudinally, sometimes transversely, sometimes obliquely, according to the different species.—At each extremity of the line an indentation may next be observed, which gradually lengthens till the two halves resemble the two continents of America connected by a slender isthmus; by the continued efforts of both portions they become finally divided, and each swims off to find for itself a separate maintenance. In 24 hours a transparent line appears across each of these divided beings, and a similar division again takes place. We have heard of the calculation of the nail in a horseshoe, and the squares on a chess-board, but these are trifles compared with the computation of the descendants of a single monad, which in one month would equal the number of the human inhabitants of this globe. A grain of sand appears of little importance, but the shores which say to the ocean "hither shalt thou go and no further, here shall thy roud waves be stayed,'" are but composed of multitudes of these grains; so these myriads of simple forms oppose a barrier to chaos and to death, and retain within appointed bounds all that may contribute to organic existence. These infusoria form, the base of that pyramid of animal life at the apex of which man has proudly stood for 6000 years without discerning that foundation to which it owed its strength and its security. The microscope is a most valuable instrument for education and for amusement; costly apparatus is not needful, nor is great advance in science necessary to the person who uses it; the most important observations have been made by the most simple means. Many of the discoveries of Ehrenberg himself were made by means of a simple pocket instrument. The microscope is available at every leisure hour; it affords quiet and never-ending amusement, and not amusement only, but the most important of all instruction, for it affords us visible proof that God not only clothes the "lilies of the field," and the grass which to-day is, and to-morrow is cast into the oven, but that He perpetually cares for those myriads of creatures, so small that they are invisible to the unaided sight; and how, then, shall we, so much more highly favoured, ever fail to rely upon His fatherly Providence and His unwearying care?

The Rev. W. Whewell, D. D., Master of Trinity College, Cambridge, "On the Material Helps of Education."

The lecturer said, that as he had not yet had the opportunity of examining the collection of the means and helps to education which the scheme of the Educational Exhibition had brought together, he must regard the subject in its general aspect, as it offers itself to our thoughts. We suppose education to be understood, not in any new or peculiar signification, but in the ordinary and familiar sense in which it is commonly spoken of among intelligent persons. We consider *general* education as opposed to special, technical or *professional* education; and we speak especially of intentional or *formal* education, as distinguished from the *spontaneous* education which precedes such formal education, and takes the place of it in some cases; and as distinguished, on the other hand, from the *ripening post education* which follows formal education.

Education, in this sense, may be defined as the process by which the individual is made a participator in the best attainments of the human mind in general, namely, with what is *rational, true, beautiful*, and *good*.

The individual participates in the *rational* attainments of man by becoming acquainted with language, which is the instrument of reason. Education begins with our own language; and none of the means of education is so universal, necessary, powerful, and extensive, as this most cheap and common one. A special point to attend to in using language for the purpose of education, is to teach the history of the language—the way in which words came to mean what they do mean. This inquiry, in the case of modern languages, contains elements additional to what it had in the case of Greek, in consequence of the influence of the subsequent history of nations and of thought upon languages. In English there are additional peculiarities in the history of the language, in consequence of its containing two main component parts—the Saxon part and the Latin (and Greek) part. The result of this history is that, at present, *the only living part of the English language is the dead languages.* The material means of education in regard to language, are school-books—as grammars and vocabularies. And it is a great improvement, recently introduced into English education in this branch, that school-books have been published in which these two elements of the language—the Tuetonic and the Latin part —are distinguished and separated.

The individual participates in the knowledge which man has attained of what is *true* by becoming acquainted with collections of truths, such as geometry, arithmetic, mechanics and astronomy. Arithmetic and geometry ought to be taught by being reduced to *intuition.* In the case of geometry there are some difficulties in this reduction, which may be illustrated, and, in fact, removed, by folding a leaf of paper. In this way we may define a straight line and a right angle, and prove that the three angles of a triangle are equal to two right angles. We may also construct a pentagon, which may be shown (though not without some geometrical skill) to be equilateral and equiangular. Also, in mechanics the relation of the weights on inclined planes may be reduced to intuition, by an ingenious illustration, devised by Stevinus, of Bruges. In astronomy, the helps of education are ancillary spheres, orreries, and the like.

It is a part of education to make the individual a participator in what is *beautiful*, even of common education, for we wish our pupils to admire what is beautiful in the thoughts, expressions, or melody of what they read, and talk of the beauties of Milton and of Shakespere. Again, musical melody has its beauty, as well as the melody of verse; and it is a great improvement in modern education that music has been made a more prominent part of it. Also an acquaintance with what is beautiful in the combination of forms and of colours, has a beneficial influence upon young persons in the way of general education, besides being important in many kinds of technical education. The collections of the Educational Exhibition will doubtless illustrate this branch.

To make man a participator in what is *good* is to teach him morality and religion; and the best mode of doing this is a matter of controversy on which we do not enter. Nevertheless, all parts of human culture are enriched, and to teach men what is true and beautiful helps the teaching of what is right and good.—*Journal of Society of Arts.*

Artificial Breeding of Fish.

A paper has lately been read before the French Academy by M. Millet, on the natural and artificial hatching of fish-spawn. M. Millet says, "in all the operations connected with the rearing of fish, in order to obtain success, much attention must be paid to the teachings of nature. It is by conforming to these principles, after studying for many years the habits and manners of fish, that I have sought to ascertain the best means of stocking the waters with this valuable description of food. For five successive years, from 1848 to 1854, I have made and caused to be made a variety of experiments in relation to artificial spawning applied to the breeding of fish. At the same time I have endeavoured to ascertain if it were possible to obtain results sufficiently satisfactory by following closer and closer the natural conditions of the spawning, so as to render the operations more simple, more economical, and more certain. I have since renewed my experiments on natural spawning, and have compared the results with those of the artificial method.

Among the different species of fish we may divide them into those which spawn in quick running streams, and those which spawn in still waters. In the first category will be found salmon, trout, grayling, &c.; in the second, carp, tench, &c. The trout makes an actual nest at the time of depositing her roe; she looks out for a bed of large gravel, or flint stones washed by running waters; these she turns over, and cleanses from all matter adhering to them, and foreign substances deposited by the water. She then hollows out cavities among the stones, into which she deposits the roe, so placing herself as for the current to carry it into the places prepared for its reception. While this process is going on, the roe is impregnated from time to time by the discharge of milt from the male, who hovers near. The female then covers up her nest with the stones which had been previously removed. Spawning beds may be established in water-courses. If the bed of the river is furnished with large gravel, or flint stones, these materials may be at once made use of for the purpose. It is only necessary to turn them over with a shovel or a rake, to form them into heaps, mounds, and small cavities. There is no difficulty in forming these spawning beds, and the expense is trifling. When the bottom does not naturally afford the proper material, gravel, flint-stones, or pieces of rock must be supplied. The formation of these artificial spawning beds, among other advantages, is attended with this, that the trout are retained in the stream thus stocked. Their efficacy is such, that I have caused trout to spawn in holes, and old ditches where I have thrown, before the regular time for spawning, several barrowsful of stone broken for mending the roads.

The grayling spawns frequently at a considerable depth. I have caused many cubic yards of rock and stone to be thrown into ditches, from ten to twelve yards in depth, and these have served as spawning beds for grayling.

For barbel, gudgeon, &c., I make in shallow running streams a sandy bottom with a slight declivity, with heaps of small stones and washed gravel, taking care to turn over and clean the materials with a shovel or rake.

The miller's thumb, the bullhead, and the minnow, breed readily in the same waters as the trout, more especially in springs and brooks.—The fry of the miller's thumb and the bullhead are hatched at a time when the young salmon, trout, and grayling are sufficiently advanced to feed on very small tender fish.

The miller's thumb looks out for stones under which cavities are found, in which she glues or sticks her eggs. But there is in this instance a previous proceeding, which consists in taking possession of a place, and *making the nest.* This fish hollows out a gallery or tunnel, with an entrance and an exit. The female glides under the stone, and then turning on her back rubs her belly forcibly against the face of the stone, depositing a portion of her roe, which immediately adheres. The male then follows into the nest, and by a similar movement to that of the female, while turning on his back, impregnates the eggs which are just laid. The miller's thumb keeps watch over her nest, and keeps at the entrance of the tunnel to drive away all injurious animals.

For carp, bream, tench, &c., the spawning beds are formed in still fresh water, which are kept by the sun's rays at a moderate temperature. The carp more particularly spawns most abundantly in ponds where the water is perfectly stagnant. Moveable spawning beds may be formed by means of fagots or hurdles placed near the edges as inclined planes, covered with pieces of turf or rushes.

The perch spawns in a manner altogether peculiar. Its eggs are fixed to each other in small groups forming a broad ribbon, which has the appearance of beautiful lace work. This fish has but one ovary, which is completely emptied at one time. In a large number of ponds and lakes the perch roe is hatched by means of faggots thrown into the

water. At spawning time the perch quits the running water, and seeks still pools. In preparing the spawning beds for this fish, masses of rushes or grass, faggots or branches, are thrown into the water; or, what is better still, boughs of trees with small branches attached (such as willow boughs) are stuck into the banks at a depth of from half-a-yard to a yard. It is very easy to gather the spawn, for all that is necessary is to raise the ribbons with a stick or a small fork.

Artificial spawning beds, applied to the hatching of certain *cyprinidæ* particularly of the bream and the roach, and of the perch, have been employed as a means of stocking waters in very many places. Since the year 1761, Lund obtained successful results by this means; he produced upwards of ten millions of young fish."

Ascent of Mont Blanc by a Lady.

A correspondent of the London *Times* says:—The ascent of Mont Blanc has just been accomplished by an English Lady. It appears that Mr. and Mrs. Hamilton, a gentleman and lady who reside near London, accompanied by nine guides, and by a boy of the village 16 years old, started from Chamouni to make the ascent on Sunday morning last, about 8 o'clock. They arrived at the Grands Mulets at 4 o'clock in the afternoon, and passed the night in the hut the guides have recently erected there; at half-past 3 the next morning they continued their journey, and after meeting with difficulties of no ordinary character succeeded in reaching the summit at about half-past 2 P.M. They rested there about 10 minutes, when the anxiety of the guides respecting the weather induced them to commence the descent, and they got back to the Grands Mulets at 5 o'clock, and passed another night in the hut. On Wednesday morning they returned thence to Chamouni, and they found this to be the most difficult part of their journey, in consequence of the descent of avalanches. They succeeded, however, in surmounting every obstacle, and were welcomed on their arrival at the village by the firing of cannon, the forming of a triumphal procession, and every other demonstration of enthusiastic applause.

A fête was given the next evening in the court-yard of the Hotel de Londres, which probably surpassed anything of the kind ever seen in Chamouni, not excepting that which took place after Mr. Albert Smith's ascent. Mrs. Hamilton had so far recovered from her fatigue as to be able to join the dancers, and she did so with much spirit. From a conversation I had with her on this occasion, I found that neither she nor her husband suffered from the rarefaction of the air at the summit, although several of the guides were so utterly prostra-trated that they fell upon their faces as soon as they reached the top. She spoke in the warmest terms of her two guides, Jean and Victor Tairray, who paid her the utmost attention during the whole route. An avalanche of immense size fell as they were passing the Grand Plateau, and in its course went over part of the track they had crossed but a few minutes before, and completely filled a *crevasse* beneath, said by the guides to be 25 feet wide and 40 deep.

This is the first time the top of Mont Blanc has ever been reached by an English lady, although two women have before made the attempt successfully, one being a French lady of Geneva, Mdlle. D'Angeville, and the other a peasant in the neighbourhood of Chamouni.

Two other ascents have been made this season, both during the present month; one by a Mr. Birkbeck, and the other by a Mr. Blackwell. Dr. Talbot an American gentleman has commenced the ascent to-day, and is now at the Grands Mulets, where he will pass the night, and, if the weather permit him, will continue his journey to-morrow. It has been so unfavourable during the latter part of the day that it is doubtful whether he will accomplish his wishes so soon, but he has expressed his intention to remain upon the rocks for a week rather than return unsuccessful.

Products of Coal—Paraffine.

The case in which James Young and others were plaintiffs, and Stephen White and others were defendants, tried before Lord Campbell and a special jury on the 28th of June last, involved questions so interesting to those who are concerned in the products of bituminous coal, and in the recognition of patent rights, that a condensed notice of it must be acceptable to our readers. It was an action brought by the plaintiffs for an alleged infringement of a patent obtained by Mr. James Young, on the 17th of October, 1850, as the inventor of "improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom." The defendants, while denying the infringement, pleaded that the plaintiff was not the true and first inventor; that the manufacture was not, at the time of obtaining the patent, a new invention within this realm; and further, that the patent did not sufficiently particularise the nature of it. The defendants are chemists and gas manufacturers, in and near Manchester under two patents for making gas by what is called the "hydro-carbon process."

It appeared that, in 1847, Mr. Young, as a scientific man, was requested, by Dr. Lyon Playfair, to analyse a mineral oil, which exuded in a coal pit at Riddings, near Alfreton, in Derbyshire of a very remarkable character, and which then excited attention. On the analysis, he was unable to procure naptha from it in sufficient quantity: but, by a further process, he was enabled to purify the oil, so as to obtain from it considerable illuminating power, and he found that it had the remarkable quality of being unaffected by the action of the atmosphere. After a while, the oil could not be procured, and Mr. Young turned his attention to the discovery of some means of artificially producing this particular fluid: and he subsequently succeeded, by distilling highly bituminous coal at a low red heat, in obtaining this same oil. He found that it consisted of a substance, in a liquid state, known under the name of "paraffine," so called from the words *parum* and *affinis*, having little affinity to any other; that it was compounded of hydr gen and carbon in almost equal parts; and that it is not decomposed by the action of the oxygen in the atmosphere. Paraffine oil is procured by distillation, but, when afterwards condensed by cold, it assumes a peculiarly fine, waxy appearance, called "paraffine," which, on the application of heat, again becomes dissolved. The oil possesses this peculiarity—that it will keep for an indefinite time; and, as it is said to be the most oleaginous or slippery oil that has been discovered, it was found useful as a lubricant for machinery. The defendants, in January, 1853, as the Hydro-Carbon Gas Company, Manchester, advertised paraffine oil, which was found of the same description and quality as that which Mr. Young was selling under his patent; and on a representation to them, they acknowledged that what they were making was paraffine oil, but stated that they obtained it by a different process. The defendants had two patents for making illuminating gas: in their process by the first patent, they used two retorts, in one of which water is dropped on coal, and partially decomposed, steam, hydrogen gas and carbonic oxide arising from it. In the other retort is an apparatus of iron, upon which oil or tar is dropped, which produces a highly carburetted hydrogen gas, emitting so much smoke, when subjected to the action of fire, that it is necessary to dilute it. This is done by applying a mixture of hydrogen gas and carbonic oxide, the products of the first retort, and the mixture produces a gas, not only very inflammable, but possessing high illuminating powers. As paraffine oil could only be procured from bituminous coal, or waxy petroleum, it was insisted, on the part of the plaintiffs as clear, that the oil could not be obtained from any form of the process specified in the defendants' first patent. Their second patent proposed to use coal, for the purpose of generating this illuminating gas at a white heat; while the subject of the plaintiffs' patent, paraffine oil, was evolved from coal only at a low red heat. It was observed that if the heat was raised above the low red heat at which paraffine was obtained from the same bituminous coal, not paraffine oil, but a totally different liquid, was produced, possessing wholly distinct chemical qualities—namely, naphthaline, with a visible trace of paraffine, which is justly considered a curious and striking phenomenon. It was alleged, that since the second patent was obtained, the object of which was to improve the mode of procuring illuminating gas, the defendants had been using their retorts at a low red heat, thereby obtaining paraffine oil, instead of illuminating gas. The plaintiffs further asserted, that if the defendants should attempt to show that they still used a white heat, it would be proved that they had recourse to the action of water, internally applied, for the purpose of reducing the temperature within; while, in order to keep up appearances, they maintained the white heat without. The plaintiffs claimed for Mr. Young the merit of the discovery; the production of paraffine oil from coal was not known before his invention; that it was an article of great practical value could not be controverted by the defendants, who professed to sell it themselves; and it was insisted that they produced it by a process which if not identical with, was at all events equivalent to that employed by him.

On the part of the plaintiffs, a number of eminent professors of chemistry, and manufacturing chemists, were examined, whose evidence

went strongly to sustain the plaintiffs' case—namely, that the production of paraffine by the distillation of bituminous coal at a low heat was a novelty, and that it had not been obtained prior to the date of the plaintiffs' patent. They were cross-examined on the part of the defendants, with the view of showing that the existence of paraffine in bituminous coal was well known to scientific men, and described by chemical writers, particularly on the Continent, before the plaintiff's discovery; and the Boghead Cannel or mineral was repeatedly referred to, but it did not appear that any attempt had been made, on the part of the plaintiffs to analyse the coal gas produced from it. It having been shown that the per centage of paraffine in Mr. Young's oil was from 12 to 13 lbs. in the 40 gallons, or from 3 to 4 per cent., and that Mr. White's contained only half the quantity, it was endeavored to be established that they could not be the same but it was proved that the latter oil also froze solid on applying cold.

The exclusive claim of the plaintiffs was strongly resisted, on the part of the defendants, by reference to a number of scientific and chemical works, English, American, French, and German, proved to have been in circulation in this country prior to 1850, all treating of paraffine as a substance well known to chemists, the product of the distillation of bituminous coal at a low temperature. It was also proved to have been procured from Wigan Cannel coal tar, obtained from the Salford Gas-works by the process recommended by Baron Reichenback in a work published in Germany, in 1833. It was insisted that he was the original discoverer, and that he had also pointed out the commercial application of this product, one of the purposes for which he states it will be useful, being the lubrication of the wheels of carriages. A specification for the manufacture of a nearly similar substance had been lodged by M. Du Buyson, 1845, and it was admitted that he had produced it, but not commercially. It was then shown that the Boghead mineral was first introduced to notice in the year 1850, and that paraffine had been extracted from the dead oil, of the residum tar produced by it in the ordinary practice of gas manufacture. It was stated that, from a ton of that coal, nearly 700 lbs. of tar can be procured, and from 140 to 150 lbs. of paraffine oil (about 15 gallons), and that from 13 to 20 per cent. of the paraffine oil so produced is pure paraffine. It was then proved that the heat best suited to the process of making hydro-carbon gas was a white heat; and that there was not a very great distance between that and red heat, was shown by the facts that the melting point of silver, 1280°, is a bright red—that of copper, 1570°, almost a white heat. In addition to the numerous publications relied on, several scientific witnesses were examined, on the part of the defendants, to displace the claim of originality asserted by the patentee, and the specification was strongly objected to. It was urged that, although the plaintiffs' patent was for "improvements in the treatment of certain bituminous substances, and in obtaining products therefrom," the only bituminous substance specified was coal. Distillation of coal was not new: the only novelty was a low heat, and it was contended that the patent was defective in not specifying what was new and what was old. It was understood that the legal objections, which were overruled, were to be made the subject of a bill of exceptions for final adjudication by the highest courts.

The Chief Justice Lord Campbell, for the purpose of taking the opinion of the jury, gave them a direction that the specification of the plaintiffs' patent was sufficient, and he then left to them two questions —first, whether that of the plaintiff was a new invention at the time his patent was taken out, or whether his process was not at that time, and previous to that time, known in England. Secondly, whether the defendants had infringed that patent. The jury retired for some time, and after, on their return, sating that, in their opinion, the specification was sufficient, they answered the question in the affirmative—that the invention was a novelty, and that there was an infringement. A verdict was accordingly entered for the plaintiffs.—*Mining Journal.*

British Exports for 1853.

A return has just been issued by the Board of Trade of the declared values of British and Irish produce and manufactures exported from the united kingdom in the year 1853, specifying the amount to each country and colony. From this document the following list has been compiled, showing the order in which the various communities of the world rank as our customers; and one of the most remarkable facts it presents is, that, owing to the extraordinary increase of more than 10,000,000 in our consignments to Australia, our own possessions now take above one-third of the entire amount, although the total has reached £98,933,781, against £78,076,854 in 1852. The United States, including California, likewise figure for a great increase—namely, from £16,567,737 in 1852 to £23,658,427, at which they now stand. It is the augmentation in this case, indeed, coupled with that to our own colonies, by which the comparison of the exports of the two years exhibits so striking an improvement, since the aggregate of shipments to all other countries has remained almost stationary, such slight alteration as has taken place being in the direction of a decline. Among the British possessions which, next to Australia, continue to show an enlargement of trade, are India, Canada, the settlements of South Africa, and Mauritius. The West Indies remain stationary, and Hongkong, owing to the Chinese insurrection, exhibits a considerable falling off. Among the foreign countries our exports to which have declined, are China, Brazil, France, Egypt, Tuscany, Naples, the republics of the River Plate, New Granada, Venezuela, Hayti, and Greece. Turkey also shows a slight reduction, but she remains far beyond Russia, although in the insignificant total to that country there has been an increase, caused, probably, by extended purchases towards the end of the year under the apprehension of a blockade. With regard to other countries, those which present the most prominent improvement—although, with the exception of Mexico, which has advanced from £366,020 to £791,940, the variations generally have not been of much magnitude—are Holland, Belgium, Spain, Portugal, Chilli, Peru, Denmark, and Sweden and Norway:—

"1. British possessions—		
Australia	£14,513,700	
India	8,185,695	
North America	4,898,544	
West Indies	1,906,639	
South Africa	1,122,630	
Gibraltar	670,840	
Channel Islands	470,107	
Mauritius	385,879	
Hongkong	375,908	
Malta	297,906	
Ionian Islands	116,567	
Other possessions	347,787	
		£33,382,202
2. United States		23,658,472
3. Germany—		
Hanseatic Towns	£7,093,314	
Prussia	579,588	
Hanover	472,179	
		£8,145,081
4. Holland		4,452,955
5. Brazil		3,186,407
6. France		2,636,330
7. Turkey—		
Turkey	£2,029,305	
Wallachia and Moldavia	179,510	
		£2,208,815
8. China		1,373,689
9. Spain		1,468,357
10. Belgium		1,371,817
11. Portugal		1,335,382
12. Chili		1,264,942
13. Peru		1,246,730
14. Russia		1,228,404
15. Cuba		1,124,864
16. Sardinia		1,112,447
17. Mexico		791,940
18. Egypt		787,111
19. Tuscany		639,794
10. Naples and Sicily		639,544
21. Austria in Italy		637,353
22. West coast of Africa		617,764
23. Denmark		569,733
24. Java and Sumatra		558,212
25. Sweden and Norway		556,183
26. Buenos Ayres		551,035
27. Uruguay		529,883
28. New Granada		450,804
29. Philippine Islands		386,552
30. Syria and Palestine		306,580
31. Venezeula		248,190
32. Papal territories		207,491

33. Greece	135,315
34. Hayti	133,804
35. Morocco	75,257
36. Senegambia	1,527
Other countries	912,662
	£98,933,781"

Toronto Harbour.

In our last issue, we stated that it was the intention of the Harbour Commissioners to strengthen the peninsula boundary of the Bay at the narrows near the Hotel. We have since had an opportunity of inspecting the plans of Mr. Kivas Tully, for the accomplishment of this work. Mr. Tully proposes to construct an embankment at the narrows, sustained by planking secured to posts sunk in the sand beach to the level of the Lake. The posts are to be about eight feet long, and the parallel walls of the embankment separated by an interval of twenty feet. This space is to be filled with sand and capped with road metal, with a view to form a permanent carriage road. On each side of this artificial roadway the sand of the peninsula is to be thrown in the form of an inclined plane, the sloping surface of which will bo about fifteen feet in breadth. The entire embankment will thus have a breadth of about fifty feet.

It is proposed to continue this embankment along the peninsula boundary of the Bay to a certain distance, in the direction of the lighthouse, and then to connect it with the city by means of its continuation along the narrow strip of land which separates Ashbridge's from Toronto Bay. The Harbour Commissioners, we are informed, have determined to limit the construction of this embankment to the extent of about 150 yards, during the present year; preferring, before authorizing its continuation beyond that point, to satisfy themselves as to its capabilities to withstand the effects of the waves of the Lake under the influence of those prolonged easterly storms which invariably visit us in the spring of the year. We are not awaro with whom this method of defending the narrows against the encroachments of the Lake originates, nor do we know whether Mr. Tully is acting in accordance with his own convictions, or under the particular directions of the Harbour Commissioners, in thus preparing for the construction of tho works we havo briefly described. We are, however, glad to find that the operations aro viewed rather in the light of an experiment than as a permanent defence for tho Harbour against the inroads of the surges of the Lake at the narrows. We havo no hesitation in expressing a conviction that, *if the Lake maintains its present level during the winter, the establishment* of a roadway in the manner described is perfectly hopeless. That the embankment, or rather its ruins, will serve the purpose of arresting the encroachment of the Lake, is more than probable, but the waves will model it after their own fashion, and eventually form a safe natural bank, in which it will be difficult to trace the outline of Mr. Tully's roadway. If the Lake falls fifteen or eighteen inches during the present year, the roadway will be protected by a new beach formed, or, wo may say, now forming, some thirty or forty yards from the present shore, and its purpose as a barrier will be neutralized. If the waters of tho Lake do not fall during the autumn more than a few inches, the artificial sloping boundary of tho roadway will be swept away, and the roadway itself undermined, until the planking assumes that inclination which will enable it to receive with the least resistance the force of a breaking wave—then the natural process of repair will commence and go on uninterruptedly.

We submit, with due respect to the experience and judgment of the Harbour Commissioners, that in devising means to give permanence to that narrow crest of sand shoal which separates Toronto Harbour from the Lake, the natural formative process by which the peninsula has increased and been maintained, should be narrowly watched and closely imitated. It has been, we believe, satisfactorily demonstrated that the materials which form the peninsula have been derived from the eastward. It should be borne in mind, however, that these materials do not "travel" uniformly. Their path of progress, if traced out, would not be parallel to the coast line, nor would they be found to pass over "equal spaces in equal times." Every gale of wind from the east or south-east pushes forward a certain quantity of the loose drifting materials of which the peninsula is composed, and forms here and there upon the coast bays and promontories which are continually changing their relative dimensions and positions. These bays and promontories are not necessarily bounded by the sand crest of the peninsula shoals. They may be, and indeed are, to a great extent subaqueous, and are then occasionally distinctly visible under certain conditions of sunshine and shade. It is altogether fortuitous whether a subaqueous bay or a promontory be formed on any part of the peninsula coast line after an easterly storm. During comparatively calm weather a bay may subsequently be enlarged or filled up, and its neighbouring promontory increased in dimensions or altogether swept away. A subaqueous promontory has been for some time forming near the spot where the breach existed at the narrows, a bay is rapidly forming at the Hotel, and the fence is being undermined. These conditions may be reversed during the first prolonged easterly storms, and under such circumstances what would become of Mr. Tully's roadway?

But is there no method of ensuring the existence of a promontory at the narrows? No contrivance can be more simple or more certain of ultimate success at the immediate point of its application. *Compel* the formation of a promontory at the narrows by the introduction of three or four groynes of small dimensions—say forty to fifty feet long, and four or five in height—projecting into the Lake. Arrest by this artifice the progress of the materials in their westerly course, until they accumulate so as to pass round or over the groynes, and a firm and stable barrier will be established, containing within itself the warrant of its durability.

Miscellanea.

Chevreul on the Harmony and Contrast of Colours—Mr. Sheriff Ruttan's Ventilating Car—Production of Cotton in the Southern States—The Victoria Bridge—The Harvest in 40 English Counties—Progress of Development in Organic Life.

M. E. Chevreul, in his new work on the Principles of Harmony and Contrast of Colours, deduces many curious analogies from the following well known fact:—

"That every colour, when placed beside another colour is changed, appearing different from what it really is, and moreover equally modifies the colour with which it is in proximity."

It thus appears that, every colour has a certain orbit of coloured atmosphere which modifies the neighbouring colours, so that red fills its vicinity with its complementary green; green, red; orange, blue; blue, orange; greenish yellow, violet; violet, greenish yellow: indigo, orange yellow; orange yellow, indigo.

M. Chevreul applies these principles to a great variety of Arts, Manufactures and devices, such as Painting, Interior Decoration, Tapestries, Carpets, Mosaics, Coloured Glazing, Paper-Staining, Calico-Printing, Letter-press Printing, Map-Colouring, Dress, Landscape and Flower Gardening, &c.

The *Athenæum* quotes the following subtleties as illustrative and curious:—

"*First Fact.* When a purchaser has for a considerable time looked at a yellow fabric, and he is then shown orange, or scarlet stuffs, it is found that he takes them to be amaranth-red or crimson, for there is a tendency in the retina, excited by yellow, to acquire an aptitude to see violet, whence all the red of the scarlet or orange stuff disappears, and the eye sees red, or a red tinged with violet. *Second Fact.* If there is presented to a buyer, one after another, fourteen pieces of red stuff, he will consider the last six or seven less beautiful than those first seen, although the pieces be identically the same.—

What is the cause of this error of judgment? It is that the eyes having seen seven or eight red pieces in succession, are in the same condition as if they had regarded fixedly during the same period of time a single piece of red stuff; they have then a tendency to see the complementary of Red, that is to say, Green. This tendency goes of necessity to enfeeble the brilliancy of the red of the pieces seen later. In order that the merchant may not be the sufferer by this fatigue of the eyes of his customer, he must take care, after having shown the latter seven pieces of red, to prescut to him some pieces of green stuff, to restore the eyes to their normal state. If the sight of the green be sufficiently prolonged to exceed the normal state, the eyes will acquire a tendency to see red; then the last seven red pieces will appear more beautiful than the others."

Mr. Sheriff Ruttan's ventilating Car is acquiring favorable notice in the States. At the request of the passengers in the ventilated car on the New York end Erie Railroad, the subjoined expression of their approval was drawn up, and unanimously signed:

"We, the undersigned, now riding in one of the cars of the New York and Erie Railroad, ventilated by Henry Ruttan, Esq., of Cobourg, Canada, are highly delighted with the results of the experiment, and have never before travelled so comfortably and pleasantly, at this season of the year, upon this, or any other Railroad. This day, August 24th, is excessively hot aud dusty, the entire train being enveloped in one continuous cloud of dust; and yet, in this car, so admirably does the ventilator perform its work, that the atmosphere about us is entirely free from dust and oppression, while we are continually breathing a pure and invigorating air. We unite, most heartily in urging upon Railroad Compauies everywhere to adopt in their cars this method of ventilation, which is superior in every respect to any other mode which we ever experienced or heard of."

The production of Cotton in Southern States of the American Union, has wonderfully increased during the last few years; we take from a Philadelphia paper, the following notice of this remarkable progress:—

The earliest record of an export of cotton from the country (U.S) is dated 1747, when seven bags were shipped from Charleston. Thus then, in less than one hundred years the trade has increased to millions of bales per annum. A curious feature in the history of this fabric is, that in 1784, or little more than half a century ago, a shipment of 71 bags of cotton was made from the country to England, and on its arrival it was seized by the authorities, on the ground that America could not produce a quantity so great.—The average annual yield for the last five years ending 1835, was estimated at 1,000,055, bales. The average yield for the same period ending in 1840, was 1,440,000 bales; aud the average annual yield for the like period, which terminated in 1850, was 2,270,000 bales. The total product of 1853, was 3,263,882 bales. In this connection the following comparative statement of the growth will be regarded with interest:—

1824,	569,249 bales.
1834,	1,254,328 "
1844,	2,394,503 "
1853,	3,262,882 "

The consumption for the last year named may be thus divided:

Export to Great Britain,	1,736,860 bales.
" France,	426,728 "
" North of Europe,	171,176 "
" Other foreign ports,	193,636 "
Retained for home use	671,009 "

The Montreal *Pilot* says,—" On the 24th July last we received an invitation to the laying of the first stone in the bed of the river, for the construction of the first pier of the bridge, and now, on the 14th September, when we write, pier No. 1 has arisen several feet above the level of the river, and the process of binding the blocks may be seen and understood. Each stone of the structure is clamped to its fellow by bands of iron, and the interstices are filled with molten lead and the strongest Roman cement. The result will be the construction of masonry as durable as that of the Collisseum or the Appian Ways, which have stood the wear and tear of time and of traffic for more than 2,000 years, and which still continue to exist as monuments of the skill and industry of man. It is a thing worthy of note, that in a new and rising country, only known to civilized men for two or three hundred years, monuments should arise to mark the progress of the age, and to compete in the world's esteem, with similar works constructed two or three thousand years ago; and if the rapid and mighty St. Lawrence is mastered by such works, then indeed is the achievement one werthy to be chronicled."

The State of Maine in an article on the same structure informs us, that: "Each of the tubes will be 19 feet in height at the end, whence they will gradually increase to 22 feet 6 inches in the centre. The width of each tube will be 15 feet, or 9 feet 6 inches wider than the rail track. The total weight of iron in the tubes will be 10,400 tons, aud they will be bound and riveted together precisely in the same manner and with similar machinery, to that employed in the Britannia Bridge. The principal part of the stone used in the construction of the piers and abutments is a dense, blue lime stone found at *Point Claire*, on the Ottawa river abont 18 miles above Montreal, about 8 above the confluence of that river with the St. Lawrence. A large village has suddenly sprung up at the place, for during the last twelve months, upwards of 500 quarrymen, stone masons, and laborers, have been employed there. Every contrivance that could be adopted to save manual labor, has been applied, and its extent will be judged from the fact that the machinery at the Quarry and at the adjacent jetty has (including the cost of the jetty) involved an outlay of £150,000. Three powerful steam Tugs and 35 barges capable of carrying 200 tons of stone, have been specially built for the work, at a cost of about $120,000. There are used for the conveyance of the stone to the piers, and by the end of September next, a Railway on the permanent line of the Grand Trunk track, will be laid down from the quarry (close to which the permanent line will pass,) to the north shore of the St. Lawrence, so as to convey along it, the stone required for the North embankment and for the northern abutment.

"The piers close to the abutments will each contain about 6,000 tons of masonry. Scarcely a block used in the construction of the piers will be less than 7 tons of weight, and many of them, especially those exposed to the force of the current, and to the breaking up of the ice in spring, will weigh fully 10 tons each. As the construction of "Pier No 1" is already several fect above the bed of the river, the process of binding the blocks together can now be seen and appreciated. In addition to the abundant use of the best water cement, each stone is clamped to its neighbors in several places by iron rivets, and the interstices between the rivets and the blocks are filled up with molten lead. If the mighty St. Lawrence conquers these combined appliances, then indeed is there an end to all mechanical resistances.

"In consequence of the increased height and width of the piers converging towards the centre, the weight of stone in those that will bear the centre tube will be about 8,000 tons each. The total amount of masonry in the piers will be 27,500,000 cubic feet, which at 13½ feet to the ton, gives a total weight of about 205,000 tons."

The London *Daily News* publishes the followiug result of the analysis of reports from 134 correspondents, spread over the 40 English counties: "Wheat—Very good, excellent, average, 31; good, full average, full crop, &c., 49; average, pretty good, &c., 32; near average, 4; under average, thin, &c., 12: middling, doubtful, or various 6. Totals—Favourable, 112; unfavourable, 12; neuter, 10. Barley—127 reports resolved themselves into: Very good, over average, abundant, &c., 33; good, full average, full crop, &c., 40; average, pretty good, &c., 20; short, light, indifferent, &c., 12; various, irregular, &c., 12. Totals—Favourable, 103; unfavourable, 12; neuter, 12. Oats—128 reports given; Excellent, over average, very good, &c., 25; good, full average, &c., 46; average, fair, pretty good, &c., 33; near average, tolerable, middling, various, &c., 11; under average, short, light &c., 13. Totals—Favourable, 104; unfavourable, 13: neuter, 11," Partial inquiries made in the Irish, Scotch and Welsh counties give similar favourable results.

In Dr. Carpenter's new edition of his Comparative Physiology many generalizations possessing peculiar interest are to be met with. Chapter I. is 'On the general plan of organic structure and development.' After a survey of the Vegetable and Animal kingdom, it illustrates the progress from *General* to *Special* in development, and closes with a notice of the 'Geological succession of Organic Life,' of which we present a short extract exemplifying the reasoning of the author. "Thus the earliest species of Palæotherium (a herbivorous quadruped having some affinity with the Tapir, but more with the Horse of the present epoch,) had the complete typical dentition, with three well developed toes on each foot; but a later species approached the horse more closely, in the reduction of the outer and inner toes, leaving the central one much larger in proportion; and in a still later species, the outer and inner toes are much more reduced, and the form and proportions of the rest of the skeleton and teeth are brought

much nearer those of the horse, which, in the full development of only a single digit of each member as well as in the suppression of some of the teeth and the remarkable development of others, must be considered one of the most specialized forms of order."

A notice, *in extenso*, of this valuable work may form the occupation and study of some future hour.

A Storm in India.—The following report from a correspondent, on whom we can rely, of an awful phenomenon, happily unknown in temperate climates, will be read with astonishment.—"At 3 p.m. of the 10th of April, while we were measuring the circumference of large hailstones that fell lightly about us, a terrific storm passed to the south-west of the station, about seven miles off. The accounts brought by natives next morning were so strange that I did not believe them, but, after some gentlemen had visited the spot and confirmed all. I, too, went to see the wreck left by the hurricane. As some days had elapsed since the occurrence, I found it impossible to approach the chaos from the putrefaction of numbers of dead bodies. An eye-witness told me that, while it was blowing pretty stiff from the south-west, a jet black mass of cloud, towering high aloft, and almost touching the ground, was seen to approach; another similar mass advancing rapidly from the opposite direction. They whirled around each other, the heat became intense, and, enveloped in the greatest darkness, houses, bamboos, trees, men, women, and cattle were hurled in the whirlwind, dashed in all directions against trees, impaled on bamboos, or buried in the ruins. On the sides of the track of the storm huge hailstones fell of the size of bricks. The track was about 800 yards broad; its length is not known, nor the extent of the devastation ascertained; 60 dead bodies were counted by gentlemen who went there; 15 persons with limbs torn and mangled, with broken arms and legs, are in hospital. Report says that 300 have been killed, besides no end of cattle. I think it very probable. As the natives build their houses, each family in little separate farms hid in clumps of bamboos with intermediate fields, the scene presented is that of numbers of undistinguishable masses of clumps of bamboos and trees torn up, crossing each other in every direction and blocked up with earth and materials that had formed houses so entirely broken up that nothing could be recognized as having formed roof or sides. In fact, boxes, beds, and things made of planks were so broken into pieces of a foot or two, and thrown about, that it was not always easy to imagine what they had belonged to. From under the masses of rubbish jackalls and vultures were pulling out the remains of human beings and cattle; in small puddles dogs, goats, &c., were drowned and rotting. The fields were covered with the skeletons of human beings, while the short thick branches of trees that stood leafless and barkless supported numbers of vultures. Vultures covered the plain, too gorged to fly at our approach, and hundreds were soaring in circles high overhead in the clear sky, marking in the heavens the course of the storm. One poor famished distracted being, with head bandaged and body scratched all over, bruised and cut, limped up to me, he had lost all his relations—father, mother, wife, and children—all had been destroyed, and he could not find where they had been carried away. It would require hundreds of men to remove the piles of uprooted bamboos, &c., that mark the homesteads of the missing; under them will probably be found those that were killed, while some, probably, had a living grave, hoping alas! in vain—that rescue would come at last, or imagining, possibly, that the whole world had been destroyed. A bungalow of a zemindar, at Dumduma, on the river, Ghoghut, was blown in smithers across the river—300 yards; in the roof two men found a flying passage, and, strange to say, survived."—*Calcutta Englishman.*

Submarine Telegraph Without Wires.—The possibility of sending electric telegraph messages across, or through a body of water, without the aid of the submarine wires, has been satisfactorily tested at Portsmouth. The place selected for the experiment was the Mill-dam, at it its widest part, and where it is some 500 feet across. Two portions of the apparatus were placed on the opposite sides of the water, and terminating in a plate constructed for the purpose, and several messages were actually conveyed across, or rather through, the entire width of the Mill-dam with accuracy and instantaneous rapidity. There appeared every possibility that this could be done as easily with regard to the British Channel as the Mill-dam at Portsmouth. The inventor is a gentlemen of scientific attainments, residing at Edinburgh, and who has been described as the original inventor of the electric telegraph, but, who, from circumstances, was unable to turn the invention to his own advantage.

Stability of Iron Ships.—The recent history of the iron screw-steamer *Sarah Sands* affords an excellent illustration of the stability of iron ships, if well and substantially built. Previously to her last sailing from the Mersey she grounded on the Woodside bank, and remained high and dry during one tide, having in her 1000 tons dead weight, until the tide flowed again, during which time she did not sustain the slightest damage. On her return passage from the St. Lawrence to Liverpool she got a-ground on the rocks of Bell Isle, where she remained four days and four nights. On her arrival in Liverpool, it was found that she was perfectly sound not even a rivet having started, nor was there the slightest bulge or unevenness perceptible. On leaving the graving-dock, the other day, she capized, owing to her ballast having been removed, but she sustained no injury. These mishaps prove not only the superior manner in which she was built, but also proves the superiority of iron ships over wooden ones; for it is difficult to suppose that a wooden vessel would have withstood all these casualties without sustaining damage. The *Sarah Sands* was built in Liverpool, by Mr. James Hodson, consulting engineer, more than eight years ago.

A New Substitute for the Potato.—In the garden of the Horticultural Society at Chiswick are growing two plants of a Chinese yam, which is expected to prove an excellent substitute for the potato. They have been obtained from the Jardin des Plantes at Paris, where they have been made the subjects of experiments that leave no doubt that it will become a plant of real importance in cultivation.

"If," says M. Decaisne, who has paid much attention to matters of this kind, "a new plant has a chance of becoming useful in rural economy, it must fulfil certain conditions, in the absence of which its cultivation cannot be profitable. In the first place, it must have been domesticated in some measure, and must suit the climate; moreover, it must in a few months go through all the stages of development, so as not to interfere with the ordinary and regular course of cropping; and, finally, its produce must have a market value in one form or another. If the plant is intended for the food of man, it is also indispensable that it shall not offend the tastes or the culinary habits of the persons among whom it is introduced. To this may be added that almost all the old perennial plants of the kitchen garden have been abandoned in favour of annuals, wherever the latter could be found with similar properties. Thus, *lathyrus tuberosus*, *sedum telephium*, &c., have given way before potatoes, spinach, and the like. Now, the Chinese yam satisfies every one of these conditions. It has been domesticated from time immemorial, it is perfectly hardy in this climate (Paris), its root is bulky, rich in nutritive matter, eatable when raw, easily cooked, either by boiling or roasting, and then having no other taste than that of flour (*fecule*). It is as much a ready-made bread as the potato, and it is better than the *batatas*, or sweet potato. Horticulturists should, therefore, provide themselves with the new arrival, and try experiments with it in the different climates and soils of France. If they bring to their task, which is a great public importance, the requisite amount of perseverance and intelligence, I have a firm belief that the potato yam (*igname batatas*) will, like its predecessor the potato, make many a fortune, and more especially alleviate the distress of the lower classes of the people." Such is M. Decaisne's account of this new food-plant, which is now in actual cultivation at Chiswick; and, judging from the size of the set from which one of the plants had sprung, it is evident that the tubers have all the requisites for profitable cultivation. One has been planted under glass, the other in the open air, and at present both appear to be thriving equally well. The species has been called *dioscorea batatas*, or the potato yam. It is a climbing plant, bearing considerable resemblance to our common black bryony, and, when it is considered how nearly that plant is related to the yams, the probability of our new comer becoming naturalized among us receives support. Whether, however, it realizes all that the French say of it or not, the trial of it in this country cannot prove otherwise than interesting and worthy of the society which has had the honor of introducing it. Let us hope, however, that it may indeed prove what it is professed to be—"a good substitute for the potato," and in all repects equal to that valuable esculent.—*Evening Mail.*

Artesian Well.—The deepest Artesian well in the world is at St. Louis, where, to furnish water to a sugar refiners, a shaft has been sunk to the depth of 2200 ft., through the rock foundations on which the city rests.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—August, 1854.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude,* 79 *deg.* 21. *min. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.
					°	°	°	°	°													
1	29·594	29·486	29.487	29·510	68·6	87·5	74·5	77·12	+10.15	0·575	0·899	0·762	0·733	·85	·71	·93	·81	Calm	S S W	W b S	4·02	0·025
2	·580	·585	·647	·606	66·6	79·0	62·8	70·10	+ 3.25	·467	·415	·441	·448	74	43	79	65	W N W	N W	N N W	6·75	...
3	·661	·577	·463	·559	56·1	75·2	63·2	65·45	— 1.40	·366	·507	·476	·470	83	60	84	77	Calm	Calm	Calm	0·10	...
4	·438	·436	·517	·475	65·8	73·3	65·7	67·85	+ 1·05	·486	·742	·515	·551	78	94	84	83	Calm	S W b S	N N W	2·58	0·210
5	·581	·578	·525	·557	59·9	77·9	63·2	67·23	+ 0.43	·421	·563	·454	·504	84	61	80	78	NWbW	S b W	Calm	2·18	...
6	·458	·441	—	—	59·9	78·1	—	—	—	·440	·393	—	—	87	42	—	—	Calm	W b N	—	10·75	...
7	·697	·697	·762	·721	56·0	70·5	52·8	59·95	— 6.73	·307	·195	·257	·255	70	27	65	54	Calm	NWbW	Calm	9·51	...
8	·832	·845	·838	·836	58·2	72·6	57·7	63·48	— 3.18	·365	·555	·304	·412	77	72	65	70	NWbN	S S E	N b W	4·00	...
9	·831	·786	·717	·773	52·4	72·9	62·2	64·22	— 2.33	·280	·440	·428	·392	73	56	78	67	N	E b N	Calm	4·60	...
10	·702	·646	·607	·645	62·5	76·2	64.6	67·92	+ 1.40	·423	·455	·522	·462	76	52	88	71	N E b N	E b N	N N E	4·54	Inap.
11	·599	·599	·595	·596	64·3	76·5	64·6	69·07	+ 2.63	·483	·637	·503	·550	82	72	85	80	N E b E	E	Calm	2·17	...
12	·595	·545	·467	·526	64·4	80·1	68·1	71·65	+ 5.32	·532	·639	·538	·582	90	65	80	78	Calm	S E	W N W	1·52	Inap.
13	·470	·508	—	—	67·6	80·8	—	—	—	·480	·494	—	—	73	48	—	—	S S W	W b N	—	9·54	...
14	·788	·751	·702	·739	56.7	71·1	59·2	62·45	— 3.78	·353	·337	·311	·344	78	45	63	63	N W	S S E	Calm	3·23	...
15	·409	·516	·576	·496	59·2	75·6	53·1	62·98	— 3.17	·435	·373	·319	·380	88	43	81	70	Calm	N W	Calm	8·08	...
16	·624	·610	·652	·630	57·8	77·2	59·1	64·45	— 1.58	·321	·267	·439	·354	69	29	89	63	W N W	W b S	N W	9·05	...
17	·665	·677	·719	·689	55·3	71·6	51·3	58·60	— 7.37	·347	·372	·275	·331	81	49	74	69	NWbW	S b E	Calm	4·71	...
18	·777	·738	·826	·779	52·6	78·0	58·2	64·83	— 1.00	·315	·382	·365	·368	81	41	77	64	Calm	S E b S	Calm	2·80	...
19	·715	·623	·579	·633	55·9	81·7	59·6	66·28	+ 0.52	·362	·454	·399	·423	83	43	81	70	Calm	S	Calm	2·27	...
20	·557	·599	—	—	63·9	86·2	—	—	—	·462	·533	—	—	80	44	—	—	Calm	N	—	7·50	...
21	·742	·627	·543	·635	56·7	86·4	76·1	74·87	+ 9.43	·359	·596	·646	·550	80	49	74	66	Calm	S b E	SWbW	4·63	...
22	·579	·635	·727	·658	76·8	87·4	66·6	77·67	+12.28	·542	·615	·466	·561	60	49	74	62	W b N	NWb N	E	7·05	0·105
23	·823	·762	·678	·748	63·2	68·2	58·6	62·40	— 2.73	·466	·520	·370	·444	82	77	77	81	E N E	E b N	Calm	2·56	...
24	·571	·536	·609	·572	63·0	98·1	75·4	80·43	+15.48	·501	·570	·655	·590	89	32	77	64	Calm	W	NWbW	8·62	...
25	·678	·673	·598	·646	66·7	75·9	66·4	69·22	+ 4.48	·435	·393	·522	·463	68	45	83	68	N N W	E b N	Calm	2·99	0·040
26	·583	·486	·583	·547	60·3	87·0	69·1	73·45	+ 8.92	·447	·673	·566	·583	88	54	82	73	Calm	S b W	W b N	4·85	...
27	·662	·717	—	—	64·9	70·9	—	—	—	·510	·496	—	—	86	68	—	—	W S W	E b N	—	2·12	...
28	·781	·792	·787	·786	56·4	78·5	59·5	65·65	+ 1.52	·403	·425	·391	·413	91	45	79	70	Calm	E b S	Calm	1·87	...
29	·776	·715	·659	·713	61·1	78·4	64·0	67·42	+ 3.60	·427	·628	·540	·530	81	67	93	81	Calm	E b S	Calm	3·03	...
30	·638	·516	·653	·620	68·3	86·9	72·9	74·87	+11.25	.609	·693	·655	·649	91	56	83	78	S	S b E	Calm	4·43	0·075
31	·795	·819	·807	·795	68·7	68·7	65·0	67·20	+ 3.88	·603	·557	·531	·565	88	82	88	87	E N E	E	Calm	4 88	Inap.
M	29·669	29·639	29·642	29·6477	61.24	78.24	63.46	68.03	+ 2.27	0.431	0.516	0·469	0·478	80	55	80	72	2·86	8·33	1·64	4.74	0·455

Highest Barometer...... 29·845, at 2 p.m. on 8th } Monthly range:
Lowest Barometer....... 29·384, at 8 a.m. on 15th } 0·461 inches.

Highest registered temperature 99°·2, at p.m. on 24th } Monthly range:
Lowest registered temperature 45°·6, at a.m. on 18th } 53°·6.

Mean Maximum Thermometer.............. 80°·72 } Mean daily range:
Mean Minimum Thermometer.............. 55°·26 } 25°·46.

Greatest daily range.........38°·4, from p.m. of 24th to a.m. of 25th.
Warmest day....... 24th. Mean temperature...... 80°·43 } Difference,
Coldest day......... 17th. Mean temperature...... 58°·60 } 21°·83.
Greatest intensity of Solar Radiation, 107°·6 on 24th, p.m. } Range,
Lowest point of Terrestrial Radiation, 35°·8 on 18th, a.m. } 71°·8.

Aurora observed on 1 night: viz. on 20th.

Possible to see Aurora on 21 nights.
Impossible to see Aurora 10 nights.
Raining on 5 days. Raining 5·3 hours; depth, 0·455 inches, which was the least quantity recorded for any August during the series.
Thunder Storms occurred on the 1st, 13th, 25th, and 30th.
Sheet Lightning, not accompanied by thunder or rain, observed on the 22nd, 26th, 29th, and 31st.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1230·21	1864·29	612·00	724·09

Mean direction of the Wind, W 28° N.
Mean velocity of the Wind, 4·74 miles per hour.
Maximum velocity, 26.6 miles per hour, from 4 to 5 p. m. on 6th.
Most windy day, the 6th; mean velocity, 10·75 miles per hour.
Least windy day, the 3rd; mean velocity, 0·10 " "
During the thunder storm and heavy squall on the 30th, the velocity of the wind from 2h. 26m. to 2. 45m. p.m., averaged 34 miles per hour.

The observed Temperature on the 24th, at 2 p.m., was +25°·7, and at 4 p.m., +23°·8 above the mean mormal Temperature of those hours respectively.
The observed Maximum on the 24th at 2 p.m. (98°·1), and the registered Maximum on the same day (99°·2), were the highest entries ever made at this Observatory.
Very few shooting stars were observed from the 9th to the 13th of this month, which is one of the periods usually given for the annual return of those Meteors.

Comparative Table for August.

Year.	Temperature. Mean.	Dif. f'm Avr'ge.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Wind. Mean Vel'y.	
	°	°	°	°	°				
1840...	64·6	—1·7	80.1	47·4	32·7	12	2·905	...	
1841...	64·4	—1·9	83·5	46·7	36·8	9	6·170	0·19	lb.
1842...	65.7	—0·6	80·7	45·3	35·4	6	2·500	0·30	lb.
1843...	66.4	+0·1	85·5	44·4	41·1	4	4·850	0·12	lb.
1844...	64·3	—2·0	82·5	44·3	38·2	17	Impt.	0·16	lb.
1845...	67·9	+1·6	82·5	44·4	38·1	9	1·725	0·19	lb.
1846...	68·4	+2.1	86·3	50·4	35·9	9	1·770	0·17	lb.
1847...	65·1	—1·2	83·1	44·9	38·2	10	2·140	0·19	lb.
1848...	69·2	+2·9	87·5	49·3	38·2	8	0·855	4·55	Miles.
1849...	66·3	0·0	79·5	51·4	28·1	10	4·970	3·76	Miles.
1850...	66·8	+0·5	84·2	43·0	41·2	13	4·355	4·46	Miles.
1851...	63·6	—2·7	79·8	43·6	36·2	10	1·360	4·62	Miles.
1852...	65·9	—0 4	81·2	46·7	34·5	9	2·695	3·30	Miles.
1853...	68·6	+2·3	91·6	47·6	44·0	11	2·575	4·23	Miles.
1854...	68·0	+1·7	98·1	47·0	51·1	5	0·455	4·74	Miles.
								0·19	lb.
M'n.	66·35		84·41	46·43	37.98	9·5	2·809	4·26	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——August, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10. P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29.863	29.814	29.704	72.0	88.0	75.0	·550	·515	·776	·71	·44	·90	S W b S	S W b S	S S W	0.41	0.91	1.31	0.101	Clear.	Clear.	Str. Dis. Thun.
2	.663	.695	.872	73.5	78.1	56.2	597	607	408	74	64	89	W N W	N W	W	12.00	14.60	27.14	...	Do.	Cum. Str. 4.	Clear.
3	.876	.789	.733	65.0	83.9	69.9	449	715	486	72	64	69	W	W	W	0.81	1.42	2.41	...	Do.	Cir. Str. 2.	Cir. Str. 8.
4	.686	.650	.726	75.1	87.8	69.8	670	670	486	78	53	69	W	W b N	W b N	0.11	1.48	0.98	...	Cir. Str. 4.	Do. 2.	Do. 4.
5	.826	.819	.788	70.4	88.1	70.1	597	568	541	82	44	74	N W b N	N W b N	S W b S	Calm	Inap.	Inap.	...	Clear.	Cum. Str. 4.	Hazy.
6	.735	.619	.682	70.5	61.0	61.0	641	531	520	74	98	95	W S W	S W b W	W N W	Inap.	1.34	3.28	1.483	Cum. Str. 8.	Thun. and Rain.	Cum. Str. 8.
7	.837	.818	.900	56.1	59.1	58.4	363	338	412	79	66	84	W N W	W N W	W N W	16.30	15.31	11.66	...	Do. 4.	Cum. Str. 8.	Clear.
8	30.050	30.068	30.198	60.9	75.7	61.4	393	407	362	75	47	66	N W b N	N W b N	N N W	3.38	Inap.	2.93	...	Clear.	Clear.	Do.
9	30.216	30.201	30.184	60.5	85.7	60.1	330	515	441	63	43	84	N N W	S S W	E b N	Calm	Calm	Calm	...	Do.	Do.	Do.
10	30.124	30.101	30.009	52.0	81.8	69.8	349	473	486	87	45	69	E b N	N W	S S W	Calm	0.36	Calm	...	Str. 10.	Do.	Do.
11	29.998	29.970	29.954	60.5	87.2	69.6	467	523	570	89	41	81	S E b E	E	E N E	Inap.	Inap.	Calm	...	Clear.	Do.	Cir. Str. 9.
12	·924	.856	.894	68.2	91.1	74.6	523	550	681	76	40	82	N	S	S S W	Inap.	Inap.	Calm	...	Do.	Do.	Do. 8.
13	.664	.649	.811	70.1	85.0	61.8	572	618	445	79	52	79	W b N	W b N	W N W	1.42	9.98	11.16	0.266	Cir. Str. 4.	Cir. Str. 6.	Rain at 4 p. m.
14	.998	.963	30.014	57.1	74.0	57.0	335	414	335	70	50	70	N W b N	W N W	N W b W	8.66	13.14	2.21	...	Clear.	Clear.	Clear. [dis. th.
15	.712	.624	29.752	54.1	59.3	56.0	400	478	436	93	94	96	S W	N	W b S	Calm	Inap.	11.43	0.136	Do.	Rain at 1 p.m.	Cir. Str. 9.
16	.824	.815	.886	60.6	69.4	58.1	393	371	367	75	52	75	N W b W	W	N W	12.13	23.66	1.14	...	Do.	Cir. Str. 8.	Do. 4.
17	.937	.882	.932	60.4	77.1	54.2	393	414	326	75	45	76	S S W	W N W	N b W	Inap.	Inap.	6.66	...	Do.	Clear.	Clear, Au. Bor.
18	30.042	30.004	.939	58.0	75.6	60.5	389	428	416	79	50	79	E N E	W N W	S W b W	Inap.	Inap.	Inap.	...	Do.	Cum. 2.	Do.
19	30.013	29.883	.798	64.0	88,1	70.1	357	465	465	89	35	64	W	W	W b N	Calm	6.83	1.71	...	Do.	Clear.	Do.
20	29.799	.874	.920	70.0	77.1	58.0	442	435	389	60	47	79	W b N	W b N	N E	5.56	15.80	2.83	...	Do.	Cir. Str. 8.	Do. Aur. Bor.
21	30.069	.752	.699	56.6	77.2	76.0	305	588	515	66	64	58	E N E	S S W	W b N	Inap.	2.38	6.00	...	Do.	Do. 4.	Do.
22	29.838	.856	.999	69.0	74.2	55.6	551	559	351	77	67	79	N N W	N N W	N E	28.03	10.66	12.71	...	Str. 4.	Cum. 2.	Cum. 8.
23	30.183	30.108	.987	53.7	78.0	65.1	337	498	516	81	52	89	E N E	S S W	S S E	Inap.	Calm	Inap.	0.113	Clear.	Cir. Str. 4.	Cir. Str. 8.
24	29.776	29.639	.725	64.0	87.0	70.6	534	670	541	89	53	74	N W b N	N W b N	N	Calm	14.07	13.00	...	Str. 10, Thunder	Clear.	Clear.
25	.945	.958	.962	60.5	73.9	57.8	441	659	398	84	82	84	N W b N	N W b W	N E	10.71	10.00	3.33	...	Clear.	Do.	Str. 2, Aur. Bor
26	.935	.889	.922	54.0	58.0	55.2	373	389	418	88	79	94	E N E	E S E	N E b E	12.28	16.33	3.80	Inap.	Str. Rain.	Rain at 2. p.m.	R'n at 8.30 p.m
27	30.030	30.002	30.095	60.4	78.0	53.0	350	523	337	86	55	81	E b N	E N E	E N E	10.73	13.13	8.98	...	Cir. Str. 4.	Clear.	Clear.
28	30.156	30.134	30.135	53.1	79.9	61.8	337	568	483	81	58	89	E N E	N W	S W b S	5.88	1.01	Inap.	...	Cum. Str. 10.	Cum. Str. 5.	Cum. Str. 10.
29	30.150	30.066	30.098	62.5	80.1	71.0	445	532	532	79	53	70	S W b S	S W b S	S W b S	Inap.	Calm	21.00	...	Clear.	Hazy.	Hazy.
30	29.821	29.814	29.944	66.0	87.2	71.0	464	854	715	72	68	95	S W b S	W N W	N W	14.10	2.14	1.46	0.166	Cir. Str. 4.	Cum. Str. 4.	Shower at 6. 20.
31	30.131	30.112	30.168	60.8	72.0	67.3	441	550	534	84	71	81	N E	E b N	E b N	2.48	3.41	1.48	...	Do. 7.	Do. 8.	Clear. [p.m.

Barometer	Highest, the 9th day	30·201
	Lowest, the 6th day	29·619
	Monthly Mean	29·910
	" Range	·582
Thermometer.	Highest, the 19th day	96°·0
	Lowest, the 16th day	47°·8
	Monthly Mean	68°·31
	" Range	48°·2
	Mean Humidity	·714
Greatest Intensity of the Sun's Rays		138°·1

Amount of Evaporation, 4·70 inches.

Rain fell on 7 days, amounting to 2·265 inches, and was accompanied by thunder and lightning on 3 days. Raining 7 hours, 45 minutes.

Most prevalent Wind, N W by N. Least prevalent Wind, E.

Most Windy Day, the 2nd day; mean miles per hour, 17·58.

Least Windy Day, the 9th day; mean miles per hour, 0.

Aurora Borealis visible on 3 nights. Might have been seen on 14 nights.

Electrical Apparatus out of order.

The Canadian Journal.

TORONTO, NOVEMBER, 1854.

Geology of Western Canada.—No. III.*

(*From the Report of Alex. Murray, Esq. Assistant Provincial Geologist, dated Montreal, January*, 1849.)

WESTERN AND HURON DISTRICTS.

Gypsiferous Limestone and Shale, and Corniferous Limestone.

There are no hard rock exposures of any kind on the coast south from the Rivière au Sable (north) for upwards of seventeen miles, or on the Sauguine River so far as we ascended it. The first discovery of such strata *in situ*, on our route in that direction, was at a point about seven miles nearly S. W. from the mouth of the latter stream, where an outcrop occurs displaying buff-coloured limestone, holding numerous organic remains, of which the forms were frequently replaced by hornstone. The beds were in no case at this place exposed above two feet over the level of the lake, and their approach to horizontality was so near that the eye could scarcely detect a slope. They came out at intervals along the shore, the surface of one bed being sometimes exposed for a considerable distance, and occupied altogether a space of four or five miles, beyond which another concealment occurs, continuing to within three miles of Point Douglas, where yellowish coloured calcareous sandstone skirts the coast line. Proceeding along the beach towards Point Douglas, we found this sandstone associated with calcareous beds holding a large amount of hornstone, with black bituminous shales and blue and drab-coloured limestones, one bed among which appeared to be hydraulic. The whole of these strata were devoid of fossils, but imperfect crystals of celestine or sulphate of strontian occurred, with quartz and calc-spar, lining drusy cavities or cracks in the rock, and numerous imbedded balls of hornstone were met with. A black band overlies the sandstone, and is of a coarse granular texture, appearing to be composed principally of an aggregation of imperfect crystals of calc-spar, while the black color results from the presence of bituminous matter, which exists in greater or less proportion in all the beds. Ascending in the section, which at Point Douglas displays a thickness of twelve feet, thin calcareous beds of a dark brown colour occur, separated by very thin layers of black bituminous shale; and over them the upper part of the cliff is occupied by thin bands of blue limestone and pale yellowish calcareous beds, sometimes over a foot in thickness, much marked by small brownish lenticular crystals of calc-spar. Between two of the beds there is a suture-like division; the two beds when separated present surfaces covered with inter-fitting tooth-like projections, the sides of which often display a fasiculated columnar structure, and a film of bituminous matter lies between the surfaces, and invests all the projections. One part or another of the non-fossiliferous section thus exposed at Point Douglas continues to occupy the coast to the southward, exhibiting gentle undulations, to a spot about half a mile beyond the Little Pine Brook, where fossiliferous beds, holding much hornstone, are seen overlying the highest of the strata already mentioned, in detatched isolated patches, for upwards of a mile, beyond which no ledge is exposed for upwards of twenty-five miles.

Where the line between the Townships of Ashfield and Colborne meets the lake, a little south of Maitland River, ledges come from beneath the high clay cliffs which face the water, and these ledges are seen at intervals along the shore for about a mile. The greatest section exposed does not afford a vertical thickness of more than six feet; the rocks resemble a part of those of Point Douglas; they are destitute of fossils, and consist, in ascending order, of gray calcareous and bituminous sandstones, cherty limestones, brown calcareous beds striped with thin bituminous shales, and pale yellow calcareous layers, sometimes three feet thick, with lenticular crystals of calc-spar, or cavities from which such have disappeared. Probably in the same relation to these rocks as the fossiliferous to the unfossiliferous of the vicinity of Point Douglas, there occur at the falls on the Ashfield River, about a quarter of a mile above the village, a set of thick-bedded dark gray calcareous sandstones and buff-coloured silicious limestones, both holding organic remains, which are more numerous in the latter. Beds similar to those on the Ashfield coast and river, probably a continuation of the same, were observed for the last time in a cliff on the Maitland River near Goderich. The following is a section of them in descending order :—

	ft.	in.
1. Thin-bedded dark gray bituminous limestone holding organic remains; a suture-like bituminous division with tooth-like and occasionally columnar-sided projections, separate two of the beds	24	0
2. Measures concealed by clay and debris	12	0
3. Pale gray or drab-coloured fine grained sandstone, with ferruginous spots and stripes and mottled with blue and yellow; no fossils	2	0
4. An irregular bed composed of an agregation of imperfect crystals of calc-spar	0	1
5. Dark brown fine-grained sandstone striped with bituminous layers, very soft and easily disintegrated until after exposure to the air, when it becomes hard	2	6

At the bridge across the Maitland River, about half a mile from the village of Goderich, and at a short distance below the place where the above section was measured, the following unfossiliferous rocks were found exposed in a continuation of the same cliff :—

	ft.	in.
2. Dark gray bituminous and silicious limestone	4	0
Brecciated, cherty and bituminous limestone	2	0
3. Pale yellowish calcareo-arenaceous bed, with ferruginous stripes and spots	1	10
4. Bed composed of an aggregation of imperfect crystals of calc-spar	0	6
5. Soft yellowish coloured sandstone with bituminous and ferruginous spots	3	0
6. Dark gray or brownish coloured bituminous limestone containing small lenticular crystals of calc-spar or cavities of the same form, some beds showing a large quantity of hornstone and thin partings of black bituminous shale	4	0

The lower and non-fossiliferous portion of the rocks thus described bears a strong resemblance in their mineral character

* In the August number of this Journal we published a Geological Map of a considerable portion of Western Canada, by W. E. Logan, Esq., F.R.S. & G.S., Provincial Geologist. We now propose to furnish monthly abstracts of those portions of the Geological Reports which describe the physical structure of the country comprehended within the limits of the Map. We are induced to adopt this method of disseminating information respecting the Geology of Canada, not only on account of its intrinsic value, but also because it is a matter of extreme difficulty to meet with copies of the earlier Reports, in consequence of the destruction of the reserve during those disastrous conflagrations which destroyed the Parliament Buildings at Montreal and Quebec.

and general appearance to that series of beds at the summit of the Gypsiferous formation of New York, which is known there as the Water-lime group, except that the beds do not contain organic remains, the total absence or very great scarcity of which is a feature that belongs, both in New York and the bordering part of Canada in the Niagara district, to the remainder of the formation. This analogy is farther supported by the fossiliferous portion of the Huron sections, in which several of the fossils seem to correspond with those figured by Hall and Vanuxem, as characteristic of the Corniferous limestone and the Onondaga limestone, which constitutes a passage to the Corniferous, and is in the western part of New York and its continuation into Canada, the formation overlying the Gypsiferous. These fossils are *Paracyclas elliptica*, *Delthyris undulata*, *Atrypa affinis*, with a *Cyathofillum* and a *Syringopora* belonging to the Onondaga limestone, neither of which have been specifically named, accompanying *Favosites gothlandica;* other species of *Delthyris* and *Atrypa* occur, with *Strophomena* and *Cypricardia*, and univalves resembling the genus *Platiceras* of Conrad. In addition to the corals mentioned, others are present, and there are also several species of Trilobites.

The Corniferous limestone extends over the greater proportion of all the western parts of the peninsula between Lakes Huron and Erie, but thick deposits of drift cover it up throughout the chief portion of the area it occupies. The only exposure of it met with in our excursion, in addition to those already mentioned, near the Sauguine, at Little Pine Brook, and on the Ashfield and Maitland Rivers, were at the Malden quarries, near Amherstburgh, at the very western extremity of the western district, where it displays thick beds of a pale yellowish limestone of a bituminous quality, abounding in fossils, and where, in addition to those kinds of remains already mentioned, it holds the bones of fishes.

As it appears probable from what has been said, that the fossiliferous rocks south of the Sauguine belong to the base of the Corniferous limestone, it may be inferred that the whole of the sand and clay covered space between them and the Rivière au Sable (north) is occupied by the Gypsiferous group, the upper members alone of which are brought into view on the shore of Lake Huron, and by a series of gentle undulations carried to Point Douglas and the other parts of the coast to Goderich. When the flatness of the strata, and the thick coating of the superficial arenaceous and argillaceous deposits in those parts of the country, are considered, it is not surprising that the mineral which in other parts renders the formation of economic importance should not have been met with. But as the district becomes settled and cleared, there is little doubt many fortunate exposures of it will be found between the mouth of the Sauguine and those spots where it is already turned to use on the Grand River. The position there occupied by the available masses of gypsum is in the middle of the formation, and wherever they have been observed in Canada, they are associated with green calcareo-argillaceous shales and thin beds of limestone. Below these shales and limestones, red marls are known to exist in Canada, not far from the Falls of Niagara, and also in New York, where that part of the formation becomes of importance as the salt-bearing rock of Onondaga. That the red marls are probably continued, in front of the Niagara limestones, to the coast of Lake Huron between the mouths of the Sauguine and Au Sable, appears to be indicated by the fact that Captain Bayfield on his map of the lake has represented a bottom of red clay to exist in soundings of 354 feet, at a spot bearing about W. by S. seventeen or eighteen miles from the mouth of the Sauguine, or about twenty-five miles in the same direction, from a point where the level of the lake would intersect the supposed probable outcrop of the marl on the land; and though it would require a slope of no more than fourteen feet in a mile to reach the red clay in the submerged locality, while the general inclination of the exposed strata is estimated at thirty feet in a mile, the difference is too small, and such a change in the dip as would be required to compensate it, too common an occurrence to make it any difficulty. With a slope of thirty feet in a mile, the total thickness of the formation, where it attains the mouth of the Sauguine, would be 300 feet.

The opinion that the economic masses of gypsum will be found to accompany the formation to which they belong to the coast of Lake Huron, is supported by the fact that such are known to exist in its farther extension on Burnt Island, not far northward of Michillimakinac, the rocks constituting the group of islands in the vicinity of which have been ascertained to belong to the gypsiferous series; and the value of gypsum in its applications to the soil renders it little doubtful that its presence will have a material effect upon the prosperity of such settlements as may be found to posses available quantities in their vicinity; but as the mineral is distributed in detatched and isolated masses, varying greatly in size and extent, and not in continuous sheets among the strata, the discovery of workable parts can only be expected as the result of careful and persevering research, continued for some time.

In addition to gypsum, hydraulic lime is a material of economic value likely to result from this formation; a bed of it at Point Douglas has already been alluded to, which in the experiments tried with it, hardened rapidly under water, after having been burnt and pulverized, and the statements of a previous report show that considerable quantities of it exist in the formation, near Paris on the Grand River. Good common material for building purposes and limestone for burning are met with in both the Gypsiferous and Corniferous formation. At Goderich, about half a mile above the bridge across the Maitland River, a dark brown sandstone, soft in the bed, but hardening on exposure, has been used for coarse building purposes, and found useful in the construction of limekilns. At the same place there are limestones in the upper part of the bank, which make a good substantial building stone, but are unfit for any ornamental part of an edifice, in consequence of a tendency to become iron-stained. The body of the gaol and court-house at Goderich is built of such a stone, but the facings of the structure, I was informed, were brought from Malden. Rocks of a similar character to those above mentioned occur at the rapids on the same river near Papp's farm, about five miles from Goderich on the London road: the strata being nearly flat, are capable of being easily quarried. At Malden, near Amherstburgh, a limestone of a whitish gray, and sometimes of a buff colour, is extensively quarried for building stone; the beds, which lie nearly flat, are from one to two feet thick, in no case require more than two or three feet of soil to be stripped from them, and in some parts are attainable at the very surface. They give a very handsome building stone, and at the base of some of the sections exposed there is a compact layer of a buff colour, somewhat resembling lithographic stone in its appearance; but for lithographic purposes it seems to be too brittle. All the beds burn to a good white lime. When the beds of the Corniferous formation hold too much of the hornstone, (from the large disseminated quantities of which it

derives its appellation,) to yield building materials, the rock then becomes applicable as road metal, for which it is well adapted; the hornstone prevails chiefly in the lower part of the formation.

Hamilton Group.

In a low cliff on the west side of Cape Ipperwash or Kettle Point, there is displayed a vertical amount of about twelve to fourteen feet of black bituminous shale, which splits into very thin laminæ, and weathers to a dull lead colour, marked in many places by extensive brown stains from oxyd of iron, while patches of the exterior in such parts as are not washed by the water of the lake, are encrusted with a yellowish sulphurous looking powder.* Many nodules and crystals of iron pyrites are enclosed in the shales, and many peculiar spherical concretions. On the east side of the Point the upper beds of the section are concealed by debris, but the lower come out from beneath the bank, exposing their surfaces a little above the level of the water, studded by the spherical concretions, over an area of several square acres. The resemblance these concretions bear in many instances to inverted kettles has probably been the origin of the name commonly applied to the Point; they are of all sizes from three inches to three feet in diameter, and while many of them are nearly perfect spheres, others are flattened a little, generally on the under side; sometimes they present one sub-spherical mass on the top of another, the upper of which is smaller than the under, giving a rude resemblance to a huge acorn; the masses split open with facility, both vertically and horizontally, and when double forms occur they are readily divided horizontally. These concretions are all composed of a dark gray crystalline limestone, presenting in many cases a confused aggregation of crystals in the centre, from the nucleus formed by which slender elongated prisms radiate very regularly throughout the mass to the circumference. In the nucleus are sometimes met with small disseminated specks of blende, but these were not observed to extend to the radiating prisms, which both in their terminations on the exterior of the sphere, and in their filiform aspect in the radii on fractured surfaces, give the mass very much the semblance of a fossil coral, for which it might readily be mistaken.

The shale is fossiliferous, and among the remains a fucoid resembling the *Fucoides cauda galli* of Vanuxem is very abundant, chiefly in the lower beds. Stems of plants supposed to be species of *Calamites*, in some instances seven to eight feet long with a breadth of three inches, are frequently seen about the middle of the section, and in these are sometimes remarked patches of a thin coating of coal, which no doubt when freshly exposed, invested the whole plant. In one place a *Lingula* (but neither of the two species represented by Mr. Hall as belonging to the Genesee slate,) was found associated with plants, in addition to what appears to be a number of minute orbicular microscopic shells.

The whole of the beach where these bituminous shales occur, appears to have been overrun by fire, which is rumoured by the Indians and others acquainted with that section of country, to have originated spontaneously, and to have continued burning for several consecutive years. That rocks containing so much bituminous matter, once ignited, should not cease to burn for months or even years, is very probable; but it is difficult to ascertain satisfactorily whether the fire was the result of natural causes or of accident. Spontaneous combustion is known to be of frequent occurrence near colleries, where bituminous shale is thrown up in heaps as refuse resulting from the working of the coal, when the shale is of a crumbling nature, and is accompanied by iron pyrites, a mineral present in most coal seams. It is not in my power to explain the phenomenon clearly, but it is supposed to be connected with the decomposition of the pyrites; but in the case of Kettle Point the same materials, bituminous shale and pyrites are present together, and it is not unreasonable to suppose that their action on one another may have originated the ignition. We observed that on digging a foot deep or more into the shingle, a faint and almost colourless vapour immediately arose from the opening, which, gradually increasing in volume and density, in the space of two or three minutes, became a distinct smoke, emitting an odour very similar to that produced by the combustion of a sulphurous coal, and evolving at the same time a considerable heat. The shingle of the beach, which is almost exclusively derived from the formation, is of a bright red colour wherever the fire has extended, the bituminous matter having entirely disappeared.

The black colour and inflammable nature of the bituminous shales of Kettle Point have suggested to some persons, as in the case of the bituminous shales of the Utica slate in other parts of the Province, the possibility of their proximity to available coal seams. But the formation to which they belong is well known in the State of New York, where useless and expensive experiments were made in it, before the institution of the State Geological Survey, in a vain search for mineral fuel; the formation has the name of the Hamilton Group, at the base and at the summit of which there are black bituminous shales, in the former case called the Marcellus, and in the latter the Genessee slate, either of them corresponding with the general condition of the Kettle Point shales; but between the Hamilton Group and the coal areas south-east of Lake Erie, on the one hand, and north-west of Lake St. Clair on the other, there occurs an important group of sandstones (called the Chemung and Portage Group); no trace of these sandstones any more than of the Carboniferous Group, has yet been met with in Western Canada.

Drift.

A great accumulation of drift was observed on the margin of the lake and on the banks of the rivers south of the Rivière au Sable (north,) consisting of clay, gravel, sand, and boulders. Allusion has already been made to their distribution on the coast, and from this they extend into the interior, and cover the greater part of the country between Lakes Erie and Huron. The clay in the cliffs overlooking the latter, was found to be very calcareous, containing sometimes so much as 30 per cent. of carbonate of lime, and constituting a rich marl, which would be of advantageous application, in an agricultural point of view, to the sandy portions of the district. The clay often contains numerous pebbles and boulders of limestone, quartz, granite and allied species derived from the ruins of rocks similar to those found in place in one part or other of the shore around the lake. Those of limestone were often discovered to hold fossils peculiar to the Corniferous formation, especially in the Township of Plympton, where they were numerous but usually water worn. The sands met with on the coast consisted of fine grains of white quartz; equally fine grains of mica, feldspar and limestone were distributed in smaller proportions,

* The substance is soft, dull, earthy, of a sulphur yellow, and in addition to possessing the exterior aspect, gives the blow pipe reactions of *Humboldtine* or oxalite of iron. It instantly blackens in the flame, without any sulphurous odour, and becomes magnetic, leaving, by the continuance of the heat, a bright red stain.

and a slightly ferruginous mixture gives it a pale yellow colour.

The strong calcareous quality of the clay which would give it value as a manure, renders it unfit for bricks or pottery. But clays suited for such purposes are found in abundance in some parts of the interior, such as in the vicinity of London and of Thorold, where it is supposed to overlie the calcareous clay.

Such brooks and rivulets as issued from marshes or swamps, often gave indications of iron ochre or bog iron ore by ferruginous incrustations on the banks or on the bottom, and in my excursion up the Grand River, numerous loose masses of bog iron ore were found strewed over the surface in the Township of Dumfries, near Galt, where, if it should be found in available quantity, it cannot fail to be of considerable importance to this thriving town, in which an extensive iron foundry is already established.

On Changes of the Sea-Level effected by existing Physical Causes during stated periods of time.

BY ALFRED TYLOR, F. G. S.

Concluded from page 60.

PART II

ALLUSIONS have already been made to the difficulty of proving whether or not the sea-level had been *gradually* elevated, because the rise of the waters would conceal the evidence of their former height except just at the mouths of rivers, where deposits of fluviatile alluvium might raise the land from time to time and keep it above the waves. The recent strata formed at a few such localities have been described by the best observers; and while there are appearances in several cases which might be to some extent explained by the supposition of a gradual rise of the sea-level, yet no proof could be obtained without the concurrent testimony of a much greater number of instances than have yet been brought forward. Sufficient information, it appears, exists to show that the quantity of alluvium in the deltas of such rivers as the Mississippi, Ganges and Po, is so enormous, that the accumulation must have occupied a period of time during which it would not be possible to conceive the sea-level stationary.

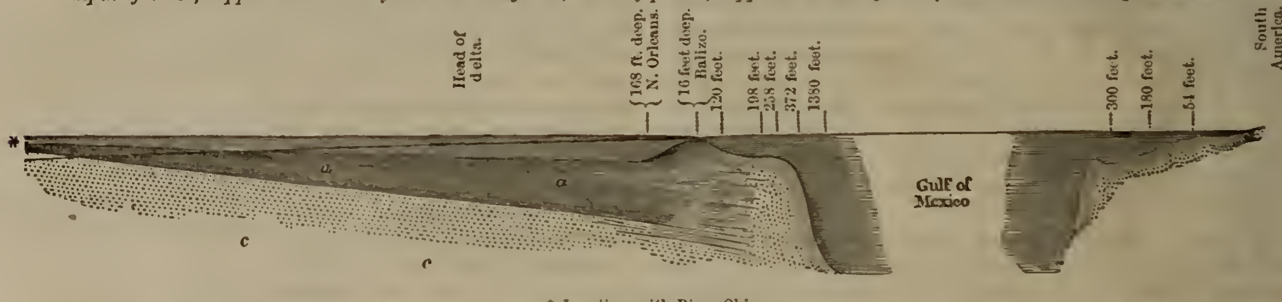
Little progress could be made in an inquiry of this kind without clear views of the operations of rivers. The recent reports of engineers upon this subject supply an important link in the chain of evidence, and enable us to understand the laws which govern the formation of alluvial plains along the lower parts of all river-courses.

The diagram (fig. 1) represents a section of 600 miles of North America, through the alluvial plains and delta of the Mississippi,* together with a section of the Gulf of Mexico from a point 100 miles east of the Balize to the continent of South America. The sea-bottom is marked from the soundings on the Admiralty Chart, and the depth of the Mississippi and its fluviatile deposit are inserted from statistics collected by Sir C. Lyell.†

* For a most valuable detailed description of the physical geography, &c. of the Mississippi and Ohio valley, see Mr. C. Ellet's paper, Smithsonian Contributions, vol. ii, 1851.

† See note, page 26.

Fig. 1.—*Diagram showing depth of the Delta (supposed* 600 *feet); area* 14,000 *square miles; height of the river above the sea level* 275 *feet at *; depth of river, supposed* 80 *to* 200 *feet in this diagram; ditto of plains, supposed to average* 264 *feet: area,* 16,000 *square miles.*

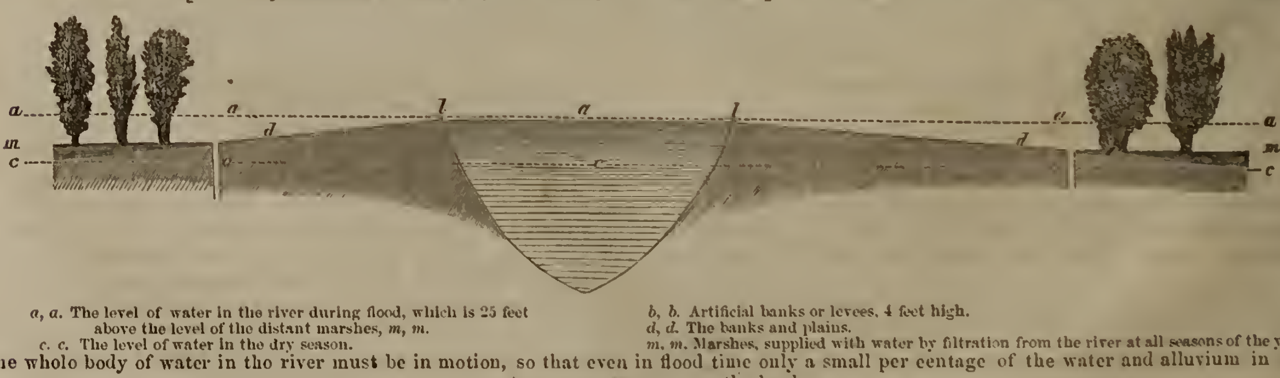


* Junction with River Ohio.

a, a. Fluviatile strata of the plains of the Mississippi; the slope of these plains is determined by measurement to be about 1 foot in 10,000 towards the sea.
c. Marine strata.

Direct distances:—Junction with Ohio to Balize, 580 miles. Head of Delta to Balize, 180 miles. New Orleans to Balize, 70 miles.
[Vertical scale 1 inch to 1000 feet. Horizontal scale 1 inch to 150 miles.]

Fig. 2.—*Transverse section of the Mississippi, where it is* 1500 *feet wide and* 100 *feet deep, running in the midst of an alluvial plain* 50 *miles wide.* [*This diagram shows the section of slow-flowing rivers in general.*] Vertical scale 100 feet to the inch.



a, a. The level of water in the river during flood, which is 25 feet above the level of the distant marshes, *m, m.*
c. c. The level of water in the dry season.
b, b. Artificial banks or levees, 4 feet high.
d, d. The banks and plains.
m, m. Marshes, supplied with water by filtration from the river at all seasons of the year.

The whole body of water in the river must be in motion, so that even in flood time only a small per centage of the water and alluvium in the stream can escape over the banks.

It will be seen that the level of the water in the Mississippi, near its junction with the Ohio, nearly 600 miles from the Gulf of Mexico, is 275 feet above that of the sea. The slope of the alluvial plains through which the river winds will therefore be less than 1 foot in 10,000.

The hills bordering the valley of the Mississippi are cut through in several places by the river, thereby exposing good sections of their component strata, consisting of alluvial deposits thought to be much more ancient than those we are about to consider.

An area of 16,000 square miles is occupied by the more modern alluvial formation between the head of the delta and the junction of the Ohio.* It is supposed to be, in the average, 264 feet deep, and is from 30 to 80 miles wide. The true delta extends over 14,000 square miles, occupying a frontage of 2½ degrees on the coast-line of the Gulf of Mexico, and extends 180 miles inland. At its southern extremity its surface is hardly above the level of high tides, but it rises gradually as it passes inland, and at New Orleans is nearly 10 feet above the sea-level.

A boring near Lake Pontchartain, of 600 feet, failed to penetrate the modern alluvium; and wherever excavations are made, the remains of trees are frequently found, apparently in the places where they grew, but now far below the sea-level. Sir Charles Lyell computes its average depth at 528 feet, and consequently nearly the whole of this modern deposit is below the sea-level, yet is supposed not to contain marine remains. The fall of the Mississippi during a course of 600 miles is shown by fig. 1; the depth of the channel varies from 80 to 200 feet until it approaches the Balize, where it shallows to 16 feet. The rise of the tide at this point is only 2 feet. The depth of the alluvial deposit below the river-channel is also indicated, together with the surface of the more ancient formation upon which the Mississippi has formed this great alluvial deposit, the bottom of which is now more than 500 feet below the present sea-level.

Mr. Charles Ellet, Jun., in a Report to the American Secretary of War, January 29, 1851, communicates the information from which diagrams are constructed. (See page 57.)

The theory of Mr. C. Ellet is, that the velocity of the stratum of fresh water is communicated entirely to the underlying stratum, composed of salt water, partially to the next stratum 3, but not at all to stratum 4, which is stationary: stratum 5 is also marine, but it flows in an opposite direction to the rest, and restores the salt water which is carried away by the friction of the upper stratum, No. 1, against the surface of No. 2.

It is supposed that the rapid increase of deposit at the bar, arises from stratum No. 5 carrying mud to that point, where its velocity is partially neutralized by impinging against stratum No. 1.

From the following particulars of the deltas of the Ganges and Po, it would appear that they are similarly situated to the Mississippi. "An Artesian well at Fort William near Calcutta, in the year 1835, displayed at a depth of 50 feet a deposit of peat with a red-coloured wood similar to that now living. At 120 feet clay and sand with pebbles were met with. At the depth of 350 feet a freshwater tortoise and part of the humerus of a ruminant were found. At 380 feet, clay with lacustrine shells was incumbent upon what appeared to be another dirt-bed or stratum of decayed wood. At 400 feet they reached sand and shingle."*

In the delta of the Po, a well bored 400 feet failed to penetrate the modern alluvial deposits; very near the bottom it pierced beds of peat, similar to those now forming. The coarser particles of mud which have already passed the mouths of rivers may contribute to the marine or fluvio-marine deposits forming outside deltas; but this can only be to a limited extent, as the great bulk of the mud is far too fine to settle near the coast. Little material could be obtained from cliffs along the sea coasts, but we have information of marine currents specially bringing sand and mud from other parts of the sea-bottom to the neighborhood of deltas. (See Mr. Ellet's observations.)

For these reasons, if the further examination of the deltas of the Mississippi and other rivers should lead to the discovery of some recent marine or fluvio-marine strata, it may turn out that such deposits have been more rapidly accumulated than the purely fluviatile beds with which they may be associated. In estimating the age of deltas, allowance, however, ought to be made for such contingences, and also for their organic contents.

Let us now turn to fig. 2, which exhibits Sir Charles Lyell's transverse section of the channel and plains of the Mississippi, and at all points throughout a course of several hundred miles. The dotted lines are introduced to show the variation of the water-level in the wet and dry seasons: *b*, *b* represents the artificial levee; *d d*, the banks and plains; *m*, *m* the swamps of the Mississippi. "The banks† are higher than the bottom of the swamps, because when the river overflows, the coarser part of the sediment is deposited on the banks, where the speed of the current is first checked" (Lyell). The channel, however, is so wide and deep, that even if there were no artificial banks to prevent floods, the river would carry into the Gulf of Mexico the principal mass of the mud it had received with the water of its tributaries; for it is only for a short time in the year that the level of water in the river is above that of the adjoining plains. The swamps and the numerous lakes formed by deserted river-bends communicate at all times of the year with the main stream. In these places mud could be constantly deposited mingled with the remains of the vegetation which grows luxuriantly in the swamps. The only supply of inorganic matter for rising the level of the vast plains through which the river winds for hundreds of miles, must be the mud deposited upon them during the periodical floods. These are very much prevented by the artificial levee; but when they do occur, their force is augmented by the water being artificially dammed up.

"I have seen, says an eye-witness, when the banks of the Mississippi burst, the water rush through at the rate of ten miles an hour, sucking in flat boats and carrying them over a watery waste into a dense swamp forest" (Lyell). It would appear that the Mississippi differs in size and proportion more than in other respects from our rivers. For instance, when floods occur upon our own alluvial plains, they are most conspicious at a distance from the stream which caused them, indicating that the parts of the plains nearest the banks are

* Lyell's Second Visit to the United States, 1849, vol. ii, pp. 146-152, 155, 169, 194, 195, 203, 243, &c.

* Lyell, *loc. cit.* p. 248; and Principles, p. 267-270.

† There is a similar section of the Nile and its banks published in the fourth volume of the Quarterly Journal of the Geological Society, p. 344, but communicated by Lieut. Newbold in 1842.

higher than those at a distance from it, and therefore that fig. 2 would also represent the *transverse section of slow rivers generally*. The similarity of the physical features presented by the lower parts of all rivers was particularly remarked by Hutton.*

It has been observed by engineers,† that in all rivers in this country the large quantities of silt brought into them by winter freshets do not tend to choke the channels, but that, at that period of the year, former accumulations of deposit are actually removed by the force of the stream; and therefore, that although winter-freshets bring down silt with them, they carry into the sea a larger quantity than they have introduced into river channels.‡ If it were allowable to assume that the unequal supply of water at different seasons of the year produces effects in the channel of the Mississippi similar to those just described on our own streams, the following consequences might be deduced from the fact that winter freshets remove more detritus than they bring down. The diminution of the speed of the current of rivers assists the deposition of silt upon their beds, as much as its increased speed in the winter season favors its removal. The summer deposit, however thin it may be, cannot occur without contracting the sizes of the channel.

Winter-freshets following a sudden fall of rain would raise the water-level of rivers rapidly, and carry it above the banks before the augmented current has time to scour the river-channel and raise it to its former capacity. Accumulations of silt, small at any one place, must each raise the water a little above its proper level, and the point of overflow will be where the sum of the small elevations amounts to more than the height of the banks, above last year's level, but floods leave a deposit of silt, &c., upon the banks they pass over, which increases the capacity of the channel; and until new deposits has again reduced the area of the stream below its proper size, inundation will not occur.

As each flood raises only the part of the bank it flows over, it is easy to see that the point of overflow will be changed from time to time; and every part of the alluvial plains through which a river flows will be visited in turn by floods, provided there are no artificial banks. These banks assist the scouring power of rivers in winter, because they retain more water in the river; but, on the other hand, silt that would have been carried over the banks is kept within the channel, and this may be the reason why the beds of all navigable rivers have become so much elevated during the historical period. The contraction of water-channels in summer, and their enlargement in winter, is thus directly traced to the unequal supply of rain at different periods of the year.

This being admitted, we have an explanation of the manner in which rivers may, by a succession of floods, build upon alluvial deposits along their courses, at the same time raising their beds in proportion to the height of their plains.

If river-channels were perfectly symmetrical in form, the identical sediment that had fallen in summer might be removed again in winter. It is, however, well known that river-channels are deep on one side and shallow on the other. The principal deposit therefore takes place on the shallow or quiet side, and the principal removal occurs from the deep side where the current runs more quickly.

This may explain why the traveller on the Mississippi sees for hundreds of miles a caving bank on one side and an advancing sandbar on the other (Lyell). When the action of the river is also unequal on its two banks in different places along its course, a channel consisting of curves instead of straight lines must be produced. When each curve, however, had assumed the complete horse-shoe form, the water, by travelling round the outer circumference of the bend, will have its effective speed reduced to that on the inner or shallow side. The current would thus become more nearly equal in all parts of the channel, and necessarily the deposit likewise; and in winter it would have a nearly equal tendency to excavate the banks on both sides, which condition of equilibrium might last for some time.

Hutton, in 1795, has remarked, that there is evidence of denudation in every country where at any time of the year the streams carry off any particles of the superficial soil.* The Mississippi must derive it vast supplies of mud for thousands of such tributaries; for it could obtain them from no other source, unless we suppose it abstracts them from its own plains. Certainly in many places soil is being removed from one part or other of its plains; but an equal quantity must be added to some other part, for the river could not make a permanent inroad into its plains without enlarging its channel. This it does not do, or it would be able to carry off the winter-freshets without overflowing, and the present artificial bank would be unnecessary.

I have thus briefly referred to observations made by British engineers which may throw some light on the causes of periodical floods and changes of channel in rivers, and also upon the formation of alluvial plains along their course. These questions need not further be entered into, because the limited growth of alluvial plains and deltas may be best illustrated by tracing the alteration in the mean level of a large part of North America that would be consequent upon a denudation sufficiently extensive to furnish the alluvium said to exist in the valley of the Mississippi. On the borders of the Gulf of Mexico at the present time marine strata are forming within a short distance of the fluviatile, and frequently alternate with them, because spaces of the sea-shore are enclosed by banks of river-mud and converted into lakes ordinarily communicating with the river, but sometimes with the sea after high tides.

The present marine or fluvio-marine deposits must be composed of mud that has passed the mouth of the river, or washed up by the sea, while the freshwater strata must be entirely formed from sand and mud carried over the river banks, or deposited on the bottom of lakes supplied by the stream before it enters the Gulf of Mexico. An idea of the amount of denudation that has taken place in the interior of North America might be either obtained from the extent of the marine deposits formed of mud that had passed the mouth of the river, or from that of the purely fluviatile and contemporaneous deposits formed from mud which had never entered the Gulf of Mexico.

* Theory of the Earth, vol. ii, p. 205-211.

† On this and the following points see First Report of the Tidal Harbors' commission, above referred to, which contains the opinions of our most celebrated engineers on the phenomena presented by Tidal and other rivers.

‡ The author has not met with any explanation of the causes that produce changes in river-channels, although the constant alterations taking place in them have been repeatedly alluded to.

* Our clearest streams run muddy in a flood. The great causes, therefore, for the degradation of mountains never stop as long as there is water to run: although, as the heights of mountains diminish, the progress of their diminution may be more and more retarded. *Op. cit.* vol. ii, p. 250.

But it is also necessary to estimate what proportion of the total quantity of mud brought down by the river is carried completely out to sea, compared to what is left either upon the marine or fluviatile portion of the delta.

Sir Charles Lyell has remarked, that the alluvium now remaining in the valley of the Mississippi can only represent a fragment of what has passed into the Gulf of Mexico; and this can readily be believed when we reflect upon the depth and breadth of the channel, and upon the short period of the year that the stream would throw any large quantity of mud into the plains even if there were no artificial banks. We must also bear in mind that only the coarse mud could settle near the shore, for the finer particles could not deposit except in very deep water. For these reasons, even if the mud carried beyond the mouth of the river is only ten times the quantity left behind on the fluviatile portion of the delta and plains of the Mississippi, this amount of detritus could not be obtained without the mean level of one-fifth part of North America being reduced 100 feet by denudation affected by the action of rain, the atmosphere, and running water.* But Hutton (vol. ii, p. 401) remarks, in 1795, that wherever any stream carried off particles of soil in its waters at any period of the year, it might be said that denundation was taking place in that country; yet he particularly observed that the waste of land was very unequal, being much more rapid in the elevated than in the more level parts of any district. It is therefore possible that, during the reduction of the mean surface-level of the land drained by the Mississippi to the amount of 100 feet, some portions of the area might be lowered many times that amount, while other portions might suffer little, or be positively raised by the superposition of alluvial deposits. We are, however, informed by Sir Charles Lyell, that the Mississippi in one part of its course cuts through ancient fluviatile beds evidently antecedent to those recent deposits we have been considering. This formation is also stated to contain the remains of species of plants and animals now existing; so that evidence is to be obtained in this district of still greater denudations (by these results) than those of which we have spoken, and which would produce changes on the surface of the earth since the introduction of the present fauna and flora of extent enough almost to realize Hutton's vision of mountains wasted away by the action of rain, the atmosphere, and running-water, and carried along river-courses into the ocean. It is not necessary to take an extreme view of this subject to gain the object we have in view, which is to show that, during the time occupied by the formation of the Mississippi delta, the sea-level might be perceptibly raised† by the agency of physical causes now in operation.

The reasons for supposing that a rise of 3 inches in each period of 10,000 years might occur, have been already discussed, and it only remains to state that, at the present rate of denudation, it would require five such periods to produce the quantity of detritus said to exist in the valley of the Mississippi;. while it would require fifty such periods to produce the requsite quantity of alluvium on the supposition that only one-tenth of the mud in *transitu* through the river was appropriated for the accumulation of its alluvial plains and deltas. Under these circumstances it appears a legitimate conclusion, that the level of the sea cannot be considered permanent for all practical purposes when it may be shown that it might be disturbed by the operation of present causes during the period occupied by the construction of a single geological formation. Elevations and subsidencies of the land or sea-bottom would also effect important changes in the height of the sea-level, sometimes counteracting and at others adding to the effects produced by the continuous operation of rivers, &c. The effects produced by these important causes would be an additional reason for not cosidering the sea-level permanent.

* The data for calculating the annual quantity of detritus carried over the river's banks, in relation with that carried down to the sea, are very imperfect. Further information on this subject is much needed

† This change of level may amount, under certain circumstances, to a great extent, but at the *lowest* calculation would be 15 feet.

It is hardly necessary to add, that the continual waste of the earth's surface by the carrying of materials into the ocean by rivers and breakers particularly attracted the attention of Hutton. He considered* that this was counteracted by elevatory movements of the sea-bottom from time to time, but particularly mentions that it was not necessary to suppose that the dry land was equally extensive at all periods. Since the fluctuation in the sea-level would be directly consequent upon the destruction of land arising from the operation of rain, the atmosphere, and running water on its surface, such changes would be in harmony with the spirit of the Huttonian therory.

Part III.

The average thickness of the deposit formed on the sea-bottom by the solid materials brought on to it from all sources has been estimated in the preceding part of the paper at 3 inches in 10,000 years, producing an elevation of that amount in the sea-level in the same period. Some portion of the oceanic area may be supposed to receive no part of this supply, while other localities nearer the coast-line obtain a great deal more than the average. In the interval between these places, where the rate of deposit is extremely high, and those where it is extremely low, must lie on extensive tract of sea-bottom, where the accumulation of detritus does not much differ from the average rate, which we have supposed to be 3 inches in 10,000 years. Such localities may be more extensive near those parts of the ocean-bottom which receive no supplies of detritus whatever, but they must stretch up to the coast-line in many places. For instance, if it is supposed that a supply of 10 cubic feet of sand or mud is obtained from each foot of frontage of any coast-line, and distributed between high-water mark and 20 miles distant, it might raise the mean level of that portion of sea-bottom 1 foot in 10,000 years.

Rivers opening on the shore might also bring down a still greater quantity of material; but although tides and currents are at work removing the sea-bed in one place and forming sedimentary strata in others from the old and new materials, there must everywhere be portions of every sea-bottom where the rate of deposit is intermediate between the highest and lowest, and may often not differ much from that of 3 inches in 10,000 years. These portions of the great oceanic area, wherever they may be situated, are particularly interesting, because on them the accumulation of sedimentary deposit is taking place without any change in the depth of water, and yet without necessitating the supposition of gradual subsidence

* These remarks of Hutton are here introduced because he takes an entirely different view of this subject to that promulgated by Sir Charles Lyell, who considers that there has been always an excess of subsidence. (See principles, 1850, p. 543.)

of the sea-bottom.* Even where deposits are taking place much faster than the mean rate, the variation in the depth of water would be proportionately less than if the sea-level had been permanent.

The limited supply of detritus derived from cliffs, and the wide distribution of that from rivers, renders it difficult to imagine any very extensive tract of sea-bottom where the rate of deposit derived exclusively from new materials should many times exceed the average. Even on areas where extreme cases of denudation and deposition occurred (in periods when the sea-bottom was unaffected by movements, subsidence and elevation), there would be many parts where the condition of depth would remain unaltered, because on them the rise in the sea-level would compensate the addition to the sea-bottom. Also if, in periods that are past, the supplies of detritus from rivers and cliffs were many times greater than at present, they must have caused proportionately greater fluctuation of the sea-level, and therefore under such circumstances there would also be parts of the oceanic area receiving deposits at the same rate that the sea was rising. There would thus have been opportunities for the accumulation of sedimentary rocks without any change taking place in the depth of the water they were formed in, during the intervals when the sea-bottom was undisturbed by subsidences and elevations. For these reasons, in examining the section of a marine formation containing throughout the remains of the same species of Mollusca, it would require independent evidence to determine whether the equal depth of water indicated by the organic remains had been preserved during the formation of the deposit by means of changes of the level of the sea-bottom, or that of the sea itself, or of both conjointly.

Great caution must also be requisite in judging of the time occupied in the formation of the older rocks from their mineral character, as the following description of passing events will also apply to periods that are long gone by.

Mr. Austen relates in one of his papers, that "with a continued gale from the west large areas of the dredging-grounds on the French coast became at times completely covered up by beds of fine marly sand, such as occurs in the offing, and which becomes so hard that the dredge and sounding-lead make no impression upon it: with the return of the sea to its usual condition, a few tides suffice to remove these accumulations."†

Mr. Deane, the submarine surveyor, also reported to the Institution of Civil Engineers, that the turn of the tide is felt as soon near the sea-bottom at a depth of 120 feet as it is at the surface: and he represents that the loose materials covering the Shambles Rocks are moved backwards and forwards with every tide.

With these facts before us, what criterion can there be (even by estimating the sources of the detritus) for arriving at the minimum or maximum rate at which sands and marls become permanent additions to the sea-bed? For the materials may present all the appearances of hasty accumulation, and yet the interval of time between the deposit of two strata of sand now contiguous may have been occupied by countless temporary deposits, as quickly brought and as quickly removed by tide, and leaving no trace whatever of their existence. For the same reasons we cannot be certain that in the valley of the Mississippi we have an unbroken sequence of fluviatile strata, in which the accumulations of one century form the base for those of the next, from the bottom to the top of the series; because there, as in marine formations, the deposits of the one period may have entirely been removed in the next. It is therefore possible that many such movements may have occured and that the delta of the Mississippi may have occupied a longer period of time for its formation than could be computed from any data remaining. In the preceding part of the paper the conclusion was arrived at, without taking an extreme view of the rapidity with which the materials may have been collected for its deposition, that the work could not have been completed within a period for which the sea-level could be considered permanent.†

There must be, however, many rivers which are only able to afford very small supplies of mud to any alluvial formations, either from deriving their water from lakes or from countries with a very small rain-fall. During a period when the gradual elevation of the sea-level was not counteracted by the effects of more powerful causes, there would be conditions near the mouths of some rivers of this kind for the surface of their plains to be gradually elevated by the operation of winter floods at a rate somewhat similar to that of the sea-level. In this manner purely fluviatile deposits might be formed in the neighborhood of the ocean, occupying positions similar to that represented in the lower part of the longitudinal section of the Mississippi, without the necessity of supposing any subsidence of the land. In the upper portions of such rivers, the periodical floods, assisted by the accumulation of terrestrial remains in the adjoining plains, would add stratum after stratum during periods when the surface of the country was unaffected by subterranean movements. It is probable that the rate of deposit might be accelerated in periods of subsidence; but the manner in which rivers form plains along their course in all countries under ordinary conditions, when no subsidence or elevation is occurring, was traced by Hutton.

Even if, in ancient periods, the rate of denudation was greater than at present, and the supplies of detritus to rivers more extensive, the fluctuations of the sea-level and the elevation of beds and plains of rivers would have been proportionately greater. There would, therefore, still have existed some localities where the rate of the formation of alluvial plains near the sea kept pace with the elevation of the waters; so that, as at the present time, conditions would have existed for the accumulation of fluviatile strata containing terrestrial remains without any subsidence of the land. This is a subject, however, that must be further studied, more especially when its value is considered in relation to the great masses of fluviatile strata either of the Mississippi, the Ganges, the Nile, or the Po. For the above reasons it would be difficult to determine, when examining sections of thick fluviatile strata, whether these accumulations of detrital matter had been formed during subsidence of the land, or during the gradual elevation of the level of rivers and seas, arising from the continual operation of ordinary physical causes.

* The effect of these causes on the general depth of the ocean would be of little importance in a geological point of view, except for *an extended period of time*, such as must have elapsed during the construction of a great serial group of strata.

† Quart. Journ. Geol. Soc., vol. vi. p. 79.

† It is hoped that in the course of a few years enough data will be forthcoming to determine more nearly the importance of this variation of level in a geological point of view.

Steam-Boiler Explosions—Mr. Fairbairn's Experiments—Proposed Associations for their Prevention.

The emphatic declaration of the jury, in a remonstrance appended to their verdict, at the recent inquest, held at Rochdale, on the bodies of the ten victims to the boiler explosion at Mr. G. Williamson's weaving sheds in the Bidgefield Mill, near that town, that they could not "separate without pressing on the consideration of the owners and users of steam-boilers throughout the kingdom the necessity there is that measures should be taken by them to ensure a thorough and frequent inspection of boilers, so as to prevent, as far as human foresight can, the recurrence of explosions," demands from us a special notice of the probable cause of that tragic occurrence. Peculiar interest is attached to the enquiry, from the fact that Mr. William Fairbairn, the justly celebrated engineer, at the solicitation of the coroner and jury, visited the scene of the accident, inspected the premises, and investigated the origin of the catastrophe. His report and evidence, therefore, furnish a valuable commentary on the proper regulations of steam-boilers, and may be considered a premonitory essay on the shameless ignorance and frightful recklessness which, we fear, are too often displayed in their management. He describes his finding the buildings, steam engine, boiler, and machinery, a heap of ruins; the boiler torn into eight or ten pieces; one portion of the cylindrical part flattened and embedded at a considerable depth in the rubbish; the two hemispherical ends burst asunder, and driven in opposite directions to a distance of 30 to 35 ft. from the original seating of the boiler. Other parts of the cylinder were projected over the buildings, and lodged in a field distant 90 yards from the point of projection; to one of which parts had been originally attached the 2-in. safety-valve, which was torn from the boiler by the force of the explosion, and carried along with its seating over a rising ground to a distance of nearly 250 yards. The other portion of the cylindrical part of the boiler was found on the opposite side in the bed of the river; and the hemispherical end of this part furthest from the furnace was rent in two, and thrown on each side to a distance from 30 to 35 ft. These two pieces had evidently come in contact with the chimney, razed it to the ground, and finally lodged themselves on the margin of the river, while the 3-in. safety-valve and pipe attached to that portion of the boiler imbedded in the river was broken from the flange; and with an extended range the 2-in. valve was projected over the river into a meadow at a distance of from 150 to 200 yards. Of the steam-engine not a vestige was to be seen, except the fly-wheel and a pump rod beside it, covered with bricks. The springing of a mine could not have been more destructive than this explosion; and we are thus enabled to judge of its terrific force.

The task of arriving at the extent of its violence was attended with many difficulties, arising from the want of an accurate knowledge of the state of the safety-valves, the density of the steam at the moment of rupture, and the ultimate strength of the boiler. Mr. Fairbairn, accordingly, entered into a few comparisons, which he conceived would be useful to those entrusted with the management of boilers, and the employment of steam of increased density and great elastic power. Gunpowder is calculated to impel a body with a force 244 times greater than the pressure of the atmosphere, which, taken at 15 lbs., gives $244 \times 15 = 3669$ lbs. as the force upon a square inch of surface—being nearly 30 tons upon a piece of ordnance of 6 in. calibre. Bullets discharged with this force, augmented by the elastic power derived from the heat generated in firing gunpowder, will leave the muzzle of the gun at a velocity of 1700 ft. per second, or nearly 20 miles a minute; and although the effects of boilers bursting with high-pressure steam may not be equally appalling, they are, nevertheless, sufficiently so to be placed in the same category as engines of destruction, and ought to be treated in the same manner and with the same precaution.

Mr. Fairbairn found the boiler in question with hemispherical ends 18 ft. long, 5 ft. diameter, and composed of plates sup posed to be 5-16ths of an inch thick—a thickness equal to a pressure of 335 lbs. on the square inch; but one of the plates being under 5-16ths in thickness, and as the thinnest part is the measure of the strength of the boiler, he reduced its power to 300 lbs., which he considered the force at which it would burst. Taking 300 lbs. as the pressure on every square inch of the surface, and the superficies at 41,000 in., there was pent up in this comparatively small space the enormous force of $41{,}000 \times 300 = 12{,}300{,}000$ lbs., or 5491 tons of elastic force compressed in an iron case of little more than a quarter of an inch in thickness.

The relative volume of steam at the pressure of the atmosphere is 1700 times that of water. At higher temperatures, and increased density, the volume is reduced in a given ratio of its temperature and density; and it is impossible to increase the temperature without increasing the pressure. In boilers having an active fire burning under them, the engine standing, safety-valves fast, it matters not how, the temperature will rise, the pressure increase, and explosions ensue, unless relieved by starting the engine, or letting off the dangerous accumulation of temperature and pressure; for which purpose the valves must be looked to, the fires regulated, and the pressure kept down below the dangerous point of resistance. Steam-boilers, according to Mr. Fairbairn, of every description should be constructed of sufficient strength to resist eight times the working pressure; and a boiler should not be worked unless provided with at least two, but he would prefer three, capacious safety-valves. Two of these valves should be nearly equal to double the area of the steam ports of the engine they are intended to drive, and the other about one-fourth of that area, as an indicator of the pressure. Nine-tenths of the boiler explosions which have occurred in that district have taken place when the engine was standing, or rather just after starting; and it has been generally found that the safety-valves were either of imperfect construction, or fastened down, or accidentally shut. The generated steam and accumulated pressure must, under these circumstances, have vent; and in case it cannot escape through the engine, or out through the safety-valves, it is sure to make way for itself—not through the usual outlets, but through the sides, ends, or bottom of the boiler. It has been asserted that explosive gas is generated in several cases where explosions occurred; but Mr. Fairbairn utterly repudiated the notion, being satisfied from experience and long observation that gas had nothing to do with them—that they were governed by a fixed and determined physical law, and that law is neither more nor less than excessive pressure. In cases where boilers explode from want of water, and the plates become red-hot, then and then only does the spheroidical theory of Boutigny come into operation, in which instances large globules of water, containing immense central heat, are formed, and bursting with great force and a loud report, might rupture the vessel in which they are contained. This could not, however, take place unless water is pumped into the boiler suddenly,

and without reflection as to the results; and he was of opinion that accidents of this description seldom, if ever, occur. This lucid explanation of the theory will, we trust, prove a salutary precaution to proprietors not to confide such dangerous engines of destruction to ignorant and incompetent workmen, for whose acts and incapacity they are, according to the law as laid down in the House of Lords, referred to in our last week's Journal, most clearly responsible.

Applying this theory to the facts of the present lamentable case, Mr. FAIRBAIRN came to the conclusion that such a boiler as that of Mr. WILLIAMSON's ought not to be worked with a pressure much above 40lbs. to the square foot, and certainly not exceeding 50lbs. It was difficult in this case, from the deficiency of the evidence, to ascertain the exact pressure; but, from the weights which had been placed upon the valves, it was necessarily excessive. In the course of his examination, Mr. FAIRBAIRN further stated, that mercurial guages could not always be relied on, and were not in every instance correct indicators of pressure. He illustrated this by observing, that in the experiments, to which we subsequently refer, he had used two such guages, and found a difference of 10lbs. between the pressure they severally indicated, with which, being of course dissatisfied, he was obliged to get columns of mercury, so as to check them, and bring them to a standard.

In answer to a question whether he conceived that one of the two valves ought to be out of the control of the engineer—whether, in fact there should be an inside valve, or one weighted from the inside, Mr. FAIRBAIRN replied that he had been once favourable to the use of lock-up valves, because he thought that they could not be tampered with. He declared, however, that he since had reason to change his opinion, and he now believed that valves completely exposed were the safer, either having a dead weight on them, or with levers in front, so that any person could see them. He once had valves on the top of the boiler, so cased up with a hood over them, that although the steam could escape through something like a Venetian blind, not even a stick or a piece of wire could be put through to tamper with the fittings. There was a pulley lever through the stuffing-box, by which the engineers were able to lift the valve, and there was plenty of room for everything to work freely. On board the navy steamers, they use the lock-up valves; but it is the duty of the chief engineer to report daily as to the state of the valves, as regularly as the log of the vessel is kept. Mr. FAIRBAIRN was pressed to say whether he considered it an advantage to have a valve locked up, or weighted from the inside of the boiler; to which he replied, that it was a difficult question to deal with, but that he had already given his opinion.

Mr. FAIRBAIRN also submitted the following tabular results of some experiments which he had made in order to ascertain the force which steam acquires in a comparatively short period of time when the engine is at rest, and the usual outlets for escape are closed:—

Time in minutes.	Pressure in lbs.	Temp. Degrees.	Volume.
0	11·75	243·00	980
1	14·15	246·75	906
2	16·35	251·00	846
3	19·25	255·25	782
4	22·35	259·75	720
5	25.75	264·00	665
6	28·95	268·37	621
7	32·15	273·00	582
8	35·75	277·00	545
9	39·95	282·00	506
10	44·25	286·37	472
11	48·35	291·00	445
12	52·75	295·37	418
13	57·75	300·00	392
14	63·75	304·25	365
15	68·95	308·75	344
16	74·75	313·00	324
17	80·35	317·75	306
18	87·25	322·00	288
19	93·95	326·12	273
20	101·15	331·00	257
21	108·75	335·62	243
22	112·00	337·00	This experiment lost.

These experiments were made with a boiler prepared for the purpose; and it will be seen that the steam which was starting 11·75lbs. on the square inch, increased in density to nearly four times the pressure, and in 10 minutes more it was nearly nine times; that it continued to increase in an accelerated ratio, until in less than 20 minutes, had he been able to continue the pressure, it would have reached a point beyond all powers of resistance, when explosion must have been the result. —*Mining Journal.*

Longitude of Kingston.

To the Editor of the Canadian Journal.

SIR,—The Longitude of Kingston is sometimes stated to be 76° 40′. This, however, differs considerably from the truth, as might be expected from the comparatively rough and hasty manner in which the portions of the principal points in a newly settled country must, in general, be first determined. Eclipses of the sun, it is well known, afford one of the most accurate means of determining the longitude, independently of such means as telegraphic communication with an Observatory, the Longitude of which has been already ascertained. The Longitude of Kingston, as deduced from two Eclipses of the Sun, and one Transit of Mercury; the time being taken from a carefully regulated clock, the pendulum having a wooden rod, is as follows:—

By Eclipse of Sun.	Longitude W.
April 25th, 1845	76° 32′ 45″.
May 26th, 1854	76° 32′ 59″.
By Transit of Mercury.	
May 8th, 1845	76° 31′ 45″.

Another Eclipse, May 6th, 1845, the time being taken from a carefully regulated watch, gave 76° 31′. The mean of these observations, 76° 32′ 7·25″ W., may, therefore, be considered as the Longitude of Kingston, very nearly. A lunar distance, worked out from observations with two instruments only, and which may be rejected except as an approximation, gave 76° 30′. The mean longitude, deduced from twelve observations of immersions, and emersions of Jupiter's satellites, a comparatively imperfect mode of its determination, gives 76° 31′ 17″.

Those who are familiar with such questions are aware that, until a regular Observatory for astronomical purposes be established, there must, even after very careful observations, be some uncertainty at least in the determination of the longitude. But the limit of error in the above mean of 76° 32′ 7·25″ W. is, in all probability, not more than from a third to a half of a statute mile.

I do not know how far the Longitude and Latitude of Toronto may be considered as ascertained.

I am, Sir, your very obedient servant.

JAMES WILLIAMSON.

Expedition to Central Africa.

Further communications have been received from Dr. Barth, from Timbuktu, giving an account of his protracted sojourn at that dangerous place. The date of the present letters is two months more recent than that of the first letters despatched thence. They reach up to the 15th of December last. They contain the gratifying news that this indefatigble and courageous traveller had regained his full health and strength. He writes that he would have quitted Timbuktu long ago,—a place where his life was greatly exposed to the effects of an unfavourable climate, and much more so to the dangers arising from the hostile disposition towards Christians of the most fanatical Mahomedan population of Northern Africa,—were it not that he would have before him certain death, and share the fate of the unfortunate Major Laing, if he left Timbuktu without sufficient protection. The murder of that excellent officer was instigated by the Fullan (or Fellhas) of Harmd-Allahi,—a tribe living south-west from Timbuktu, the same faction that is much opposed to Dr. Barth. These Hamd Allah Fullan had received from their chief the most peremptory order to effect the capture of the traveller, and bring him to his head-quarters, whether dead or alive. For they had expressed their disbelief in the pretended character of Dr. Barth being an ambassador from Stamboul; and they had demanded all his papers, to ascertain whether they substantiated what the Sheikh el Bakay had caused the great man of the people to believe. Hitherto their hostility has availed nothing, owing to the protection of Sheikh el Bakay, and to the energetic bearing as well as the unceasing watchfulness of Dr. Barth himself. Unhappily the renowned Sheikh has no military power of any kind, his authority consisting solely of an extensive spiritual influence over a great portion of Western Sundan. Dr. Barth, therefore, and his own small retinue, are almost at all times well armed and ready to resist effectively any sudden attack. It is greatly to be regretted that Dr. Barth is not in possession of a letter from the "Sultan of Stamboul," inasmuch as he states most emphatically that he would then not be in the least molested by any of the Mohammedan inhabitants. He hoped, however, to be able to depart from Timbuktu by the close of the year, and thus be freed from a situation which must at once be highly detrimental to mind and body.

While preparing the present letters Dr. Barth had the great joy to to receive Auab, the mighty chief of the Tingeregif, a Tuarick tribe inhabiting the regions east of Timbuktu along the Kowara, or Isa Balleo as it is more properly called there. That long-expected chief came, on the bidding of El Bakay, as the traveller's protector, with a welcome escort of 100 horseman, to see him safely through his dominions, on his way back to Sakatu. The news of Dr. Vogel having been despatched from Europe to join him, had also reached Timbuktu, and given him the utmost delight.

Dr. Barth had collected a great mass of information, and drawn up various maps; of both of which he sent a small but valuable portion on this occasion. There are no further news from the party under Dr. Vogel; but ample communications may be expected in the course of the present month. AUGUSTUS PETERMAN.

Mining Statistics—Coal, Copper, &c.

Coal may be justly considered the most important mineral product, and 265,198 persons were employed in Great Britain in 1851, either in extracting it from the earth, distributing it amongst the consumers, or manufacturing it into coke or gas. The owners of collieries are returned as 703 in number; agents and factors, 2342; coal miners or colliers, 150,722 men; 65,644 youths, or 216,366 in the aggregate; 10,507 persons are returned as coal merchants or dealers, and 11,691 as coal heavers or coal labourers. Besides this enumeration, 1752 men are returned as coke burners or dealers, and 413 as charcoal burners. The census also presents to us 19,860 men, and 3473 youths as stone quarriers; 2811 men as stone cutters; 6442 as slate quarriers; 5623 as limestone quarriers or burners; 1827 as marble masons; 23,374 men and 6586 youths as brickmakers: and 2338 as plate layers.

The copper miners are 18,468: viz, 12,768 men, and 5700 youths; those engaged in the manufacture of copper are 2115, and the coppersmiths, 14,443—3918 females, namely, 1565 women, and 2353 girls, are returned under the class of copper miners, a number exceeding the females returned as coal miners, amounting only to 2649. Another subclass presents 12,912 tin miners,—8607 men, 4305 youths, besides 843 women, and 1295 girls. The lead miners are 16,680 men, 4937 youths, 400 women, and 513 girls. These are, of course, exclusive of the very extensive classes engaged in the manufacture and working of these several metallic products. Our limits will not permit us to pursue this enquiry, or present an enumeration of the vast variety of arts connected with metallic manufactures, particularly those of iron and steel. We have confined ourselves to the leading classes of our mining population, and the rapid improvement and commercial increase in England within the last half century demonstrates the great national advantages which the empire derives from their labours. To ameliorate their lot, to improve their social condition, and to render their lives and persons comparatively secure in the perilous employments to which they are destined, have been objecis to which we have long earnestly devoted our efforts. While it is the painful duty of this Journal to record, week after week, fatal casualties in our coal mines, attended with lamentable consequences, we feel for the infirmities of our nature, when we admit that the men who are the sufferers are, generally, also the authors of those calamities. To their reckless disregard to the most solemn admonitions, to their careless contempt for the most appalling examples, can, in almost every instance, be traced the causes of colliery explosions—a total disregard of human life, substituting the certainty of mischief in the naked candle for the almost unerring security of the safety-lamp. This deplorable want of prudence, this dificiency in due discipline, can only be fairly met by improved training and early cultivation. It is the imparative duty, therefore, as well as the decided interest of the colliery proprietors, amounting to so large a body in number as the census presents to us to introduce and encourage amongst the coal mining population—classes mutually dependent on each other—a system of education commensurate with their requirements.—*Mining Journal.*

Report of the British Emigration Commissioners.

The annual report of the Emigration Commissioners has just been published. From this it appears that the total emigration of last year was 329,937, being 38,827 less than in 1852. There was a diminution of 26,480 to Australia, and 13,376 to the United States, the falling off being accounted for in the case of Australia by the greater excitement regarding the gold discoveries prevalent during the summer and autumn of 1852, and in that of the United States by the departure of a smaller number of Irish, the aggregate emigration of the latter people throughout the year being estimated at 199,392 against 224,997 in 1852, The remittances from their relatives in America were, however, larger than in any previous year, the amount sent through the various banks, apart from private channels, being £1,439,000. With respect to the Australian emigration, the total from the united kingdom to all the colonies was 61,401, or about one-fourth of that of the United States. Subjoined are the general figures:—

United States		230,885
Australia—		
New South Wales	10,673	
Victoria	40,469	
South Australia	6,883	
Western Australia	965	
Van Diemen's Land	991	
New Zealand	1,420	
		61,401
Canada, &c.		34,522
East Indies		928
Central and South America		833
West Indies		600
Cape of Good Hope		369
Western Africa		308
Mauritus		53
Hongkong		37
Falkland Islands		1
		329,937

According to a supplementary statement, it also appears that the emigration during the first three months of the present year has been 49,756 persons, against 60,867 in the corresponding period of 1853, and 59,523 in that of 1852. There has been a continued dimunition in the departures to the United States, but in those to Australia, although there is a great falling off as compared with the first quarter of last year, there is a considerable increase as compared with the first quarter of 1852. Of the total, 49,756 emigrants, 26,128 were Irish, 12,430 English, 2,965 Scotch, and 8,233 foreign or unspecified. This proportion of Irish is much smaller than in 1852 or 1853.—*Evening Mail.*

An Iron Coffer Dam.

In a report of the proceedings of a semi-annual meeting of the Cornwall Railway Company in England, embracing the report of Mr. Brunel, the Engineer, on the works of the Saltash Bridge, on a part of the line of unfinished railway between Truro and St. Anstell, we find a description of a coffer-dam of a novel construction, sunk in a very deep part of the river, to facilitate the construction of a pier for the support of the centre of the bridge which forms a necessary part of the line. The dam in question is not only of a novel structure, but it is made to shut out water to a greater depth than any other work for a similar purpose that we have before seen any account of, viz., a pressure, under high tides, of 70 to 80 feet. It is so constructed as to act as the principle of the diving bell, in case the water should find its way into the inclosure. But it seems to have thus far served its purpose, without a resort to this apparatus. The structure is thus described:

"It consists of an iron cylinder 37 feet in diameter and 85 in height, containing, within itself all the arrangements of air chambers, passages, &c., necessary for using it either as a large diving bell or simply as a coffer dam, as circumstances might require, and so constructed as to be afterwards divided into two parts vertically, and removed after the pier shall have been built within it. The whole, weighing upwards of three hundred tons, was safely launched and floated into place, where it was raised perpendicularly, and pitched upon its lower edge in the centre of the river. The river is at this point upwards of 50 feet deep at low water of neap tides, and except for a short space on the turn of the tide, there is a considerable current; under such circumstances, this cylinder, was pitched upon its lower edge accurately—that is, within three or four inches of the exact point required. Since then the work has been carried on at the bottom of the cylinder, as in a diving bell, against the pressure of water occasionally of 70 and 80 feet. The mud and other deposits, forming the bed of the river from 10 to 12 feet in thickness, have been removed, and cylinder is now resting on the rock, and preparations are making for excavating the rock into level beds for receiving the masonry."

The railway of which the branch now under construction, and nearly in readiness to receive the rails, forms a part, is an extension of the line of Great Western, the Bristol and Exeter, and the South Devon Railways, throughout a great part of the county of Cornwall to near the Land's End.—*Railway Times.*

Friendly Societies.

Mr. Finlaison, in the second part of his report upon friendly societies, furnishes very useful and elaborate tables showing the just rates of pecuniary contributions which should be paid in order to secure allowances in sickness, old age, and at death. This report has been prepared at the instance of the Treasury, and it contains so much valuable information that it ought to be carefully perused and studied by the members of every friendly society in the kingdom. For the ordinary purposes of his calculations Mr. Finlaison divides the population likely to avail themselves of these societies into those engaged in general labour, in light labour, and in heavy labour; but he observes that nine out of every ten established friendly societies are framed upon the principle of paying to the fund one uniform sum—every man alike, and that any advice for the adoption of a contrary method in the way of a graduated scale is generally received with impatience and treated with neglect. He observes that the half century of time which is comprised between the 16th and 66th years of age appears to be precisely the interval of life, during which man is destined to labour; and that on the general average the sickness for the first 25 years is 182 days, and for the ensuing 25 years 362 days, or about one week per annum in the first case and two weeks per annum in the second. The majority of clubs close their doors against new members at the age of 45, and many admit none above 40, but up to these ages, as we have before stated, all who are eligible contribute the same amount. Our able actuary, however, ascertains that between the ages of 15 and 65 a man employed in light labour undergoes but 467 days' sickness, while one employed in heavy labour is visited with 581 days' sickness; and hence he argues that where the former should pay for allowances in sickness during the working period £1 per annum, the latter ought to pay £1 4s. 10½d., or nearly 25 per cent. more. Practically therefore where the common rate of weekly contribution for allowances in sickness is 6d. for the man engaged in light labour, his comrade engaged in heavy labour ought to pay one-fourth more, or 7½d. This being apparent, Mr. Finlaison recommends that societies should as much as possible limit the members to persons of one or other class of occupation, or, where that cannot be done, that the safe plan would be to adopt for all the rates derived from the experience of those employed in heavy labour, "because," he cautiously and characteristically observes, "those scales which are adopted to the greater risk will always comprehend the less." So much for sickness. The next portion of the report relates to mortality.

Average Illness among the Labouring Classes.—Upon this subject Mr. Finlaison, in his second report upon Friendly Societies, affords some interesting information which is worthy of a careful perusal by the managers of those institutions. From the statistics furnished to him he calculates the average number of day's illness per annum suffered by the population at different ages. At the age of 45 he states that 99 out of the 100 benefit clubs close their doors to the admission of candidates, and we find that above that age the number of illnesses begin to increase. Between 15 and 16, the average number of days per annum with persons engaged in general labour is 6¼; between 16 and 26, 6¾; between 26 and 36, 7; between 41 and 46, 8¾; between 46 and 51, 10½; between 51 and 56, 12¾; between 56 and 61, 16¼; between 61 and 66, 23½; and between 66 and 71, 36 days. Mr. Finlaison adds, on an examination of the amount of sickness per annum recorded for the whole mass of the male members of Friendly Societies, from the age of 15 to that of 85, it may be premised that almost exactly five years' sickness is undergone by the man in the 70 years of time. But during the period of labour—that is, from the commencement of the 16th year of age to the close of the 66th—there are in this 51 years but 78 weeks, or exactly one year and a-half of sickness. Further, that in respect of this period of labour, the sickmess, during what may almost be termed its second moiety—viz., from the age of 41 to that of 66—is almost exactly the double of that undergone in the previous moiety—from the age of 15 to that of 41 years. For the sickness during the first 26 years of manhood is exactly half-a-year, or 182½ days, while it is 362½ days, or almost exactly one whole year, during the next ensuing 25 years of maturity.

Process of whitening Pins and Needles made of Iron and Steel.

BY MM. VANTILLARD AND LEBLOND.

It well known that pins made of brass wire are deficient in strength and elasticity, and accordingly they have been replaced by pins made of iron or steel: but it is necessary to tin them over. This operation, however, cannot be performed equally well with iron as with brass; the pins have a rough, uneven surface, which renders them inconvenient to use, as they are liable to tear the cloth.

Messrs. Vantillard and Leblond, wishing to avoid this defect, formed the idea of first covering the iron with a thin coating of copper or other metal having a greater affinity for tin than iron has: but in order that this result shall be satisfactorily attained, it is necessary to polish and pickle the pins before coppering them. The above named manufacturers have most ingeniously effected the polishing, the pickling, and the coppering, by one single operation. To treat for example, 2 kilogrammes (a little more than 4 lbs. 6½ oz.), 4 litres (about 7 pints) of water, 300 grammes (10 ounces 9 drachms, avoirdupois, by weight) of oil of vitriol, 30 grammes (15 ounces 13 grains, avoirdupois) of white copperas, and 7 grammes (about 108 grains, avoirdupois) of sulphate of copper, are mixed together; this mixture is allowed to dissolve during twenty-four hours. The bath being thus prepared, it is to be indroduced into a barrel of wood, made pitcher-like, and mounted upon an axis. Into this barrel, which has a capacity of about 35 pints, the pins are now to be put; it is then turned rapidly during half an hour, when the pins will be found to have received a pickling, a polishing, and a slight coppering. After the lapse of this time, 20 grammes (about 10 drachms 8 grains avoirdupois) of sulphate of copper in crystals (blue stone), are to be added, and the barrel again turned during 12 minutes, when a solid coppering will be effected with a finely-polished surface. This done, the liquid in the barrel is to be decanted off, and may be used repeatedly for the same purpose: the pins

are washed in cold water, then put in a tray containing a hot solution of soap, and agitated for about two minutes. The soap ley is decanted off, and the pins put into a bag with some fine sawdust and shaken, by which means the coppered surface assumes a brilliant appearance. The pins thus prepared may be tinned in the ordinary way, but the operation can be effected much more rapidly than in the case of ordinary brass pins. The articles made in this way are far more beautiful and useful than those made in the ordinary way. This process is the more deserving of attention at present, quite independent of the superior quality of the pins, in consequence of the exceedingly high prices of brass wire.—*Bulletin de la Societe d'Encouragement, March* 1853, *p.* 142.

Twenty-fourth Meeting of the British Association for the Advancement of Science.

LIVERPOOL, SEPTEMBER 20.

The President's Address.

Gentlemen of the British Association,—When I first set myself to the task of preparing to address you on the present occasion, my impulse was to begin with an apology for appearing before you in so prominent a position—for assuming apparently a station in the world of science for which I had no pretensions. On second thoughts, however, it appeared better—more respectful in fact, having consented, though with unfeigned reluctance, to accept the office—to say no more on that head, but to discharge its duties as best I might. This, however, I must ask of you, not to expect from me what you have had from many of my predecessors, a luminous review of the state of Physical Science—a recital of its various recent triumphs—and suggestions for their further extension: that I should, in the words of the poet, though in a different sense,

> "Allure to brighter worlds, and point the way."

Though I have been no indifferent spectator of that rapid and triumphant march of science, which, within the last fifty years, has been extending and enriching the old domains of knowledge, and planting, as it were, new colonies in hitherto unexplored and untrodden regions, yet I have been only a spectator—my avocations have been less with the properties of matter than with the busy concerns of men; and if I attempted now to assume, for the first time, the philosophic garb, I am afraid that the awkwardness of my gait would soon betray me. There are, however, some points of high and general interest, which, in a meeting like the present, cannot be entirely neglected, and in regard to which the kindness of friends has supplied me with some matter not unworthy of being submitted to your notice. How, for instance, in the land of Newton, and in the greatest seaport of the world, should I neglect astronomy? And here Professor Challis has been good enough to furnish me with a statement of its present condition and recent progress, which with your permission, I will lay before you:—

"*Notes on the Present State of Astronomy.*

"MEMORANDUM BY PROF. CHALLIS.

"Since the meeting of the British Association last year, four planets and four comets have been discovered. Three of the new planets were found at Mr. Bishop's Observatory, two by Mr. Hind, and one by Mr. Maith. This last was also discovered the following night at the Oxford Observatory—another of the many instances presented by astronomy of independent discoveries made nearly simultaneously. The fourth planet was found at the Observatory of Bilk, near Dusseldorf, by Mr. R. Luther, an astronomer distinguished by having already discovered two planets. Of the comets, one was discovered at Berlin, two at Gottingen, and the fourth was seen very generally with the naked eye at the end of last March. None of them have been identified with preceding comets. The large number of planets and comets discovered of late years, while it evinces the diligence of astronomers, has, at the same time, brought additional laborers into the field of astronomical science, and contributed materially to its extension. The demand for observations created by these discoveries has been met by renewed activity in existing observatories, and has led to the establishment, by public or private means, of new observatories. For instance, an observatory was founded in the course of last year by a private individual at Olmutz, in Moravia, and is now actively at work on this class of observations. Various such instances have occurred within a few years. In addition to the advantages just stated, the observations called for by the discovery of new bodies of the solar system, have drawn attention to the state of stellar astronomy, and been the means of improving this fundamental part of the science. The following are a few words on the existing state of stellar astronomy, so far as regards catalogues of stars. Subsequently to the formation of the older catalogues of bright stars, astronomers turned their attention to observations in zones, or otherwise of smaller stars, to the ninth magnitude inclusive. Lalande, Lacaille, Bessel, Argelander, and Lamont are the chief labourers in this class of observations. But these observations, unreduced and uncatalogued, are comparatively of little value. The British Association did great service to astronomers, by reducing into catalogues the observations of Lalande and Lacaille. A catalogue of part of Bessel's Zones has been published at St. Petersburg, and a catalogue of part of Argelander's at Vienna. Lamont's Zones have also been reduced in part by himself. The catalogue of 8377 stars, published by the British Association in 1845, is founded mainly on the older catalogues, but contains, also, stars to the seventh magnitude inclusive, observed once only by Lalande or Lacaille. The places of the stars in this catalogue are, consequently, not uniformly trustworthy; but as the authorities for the places are indicated, the astronomer is not misled by this circumstance. The above are the catalogues which are principally used in the observations of the small planets and of comets. This class of observations must generally be made by means of stars as fixed points of reference. The observer selects a star from a catalogue, either for the purpose of finding the moving body, or for comparing its position with that of the star; but, from the imperfection of the catalogue, it sometimes happens that no star is found in the place indicated by it, and in most cases, unless the star's place has been determined by repeated meridian observations, it is not sufficiently accurate for final reference of the position of the planet or comet. In catalogues reduced from zone observations the star's right ascension generally depends on a single transit across a single wire, and its declination on a single bisection. This being the case, astronomers have begun to feel the necessity of using the catalogue places of stars provisionally, in reducing their observations, and of obtaining afterwards accurate places by meridian observations. It will be seen by this statement that by the observations of the small planets and of comets, materials are gradually accumulating for the formation of a more accurate and more extensive catalogue of stars than any hitherto published. The British Association would add greatly to the benefits it has already conferred on astronomical science, by promoting the publication, when sufficient materials can be collected, of a general catalogue of all stars to the ninth magnitude inclusive, which have been repeatedly observed with meridian instruments. The modern sources at present available for such a work are the reduced and published observations of the Greenwich, Pulkowa, Edinburgh, Oxford, and Cambridge Observatories, and the recently completed catalogue of 12,000 stars observed and reduced by the indefatigable astronomer of Hamburgh, Mr. Charles Rumker, together with numerous incidental determinations of the places of comparison stars in the *Astronomische Nachrichten.* To complete the present account of the state of stellar astronomy, mention should be made of two volumes recently published by Mr Cooper, containing the approximate places arranged in order of right ascension of 30,186 elliptic stars from the ninth to the twelfth magnitude, of which only a very small number had been previously observed. The observations were made with the Markree Equatorial, and have been printed at the expense of her Majesty's Government. The determination of differences of longitude by galvanic signals is an astronomical matter of great practical importance. This method, employed first in America, was introduced into England by the Astronomer Royal, and has been applied to the determination in succession of the differences of longitude between the Greenwich Observatory and the observatories of Cambridge, Edinburgh, Brussels, and Paris. In the first and last instances results have been published which prove the perfect success and accuracy of the method. Mr. Airy, on recently announcing in the public papers the completion of the operation between the Greenwich and Paris Observatories, justly remarks that such an experiment could not have been made without the assistance afforded by commercial enterprise, and that commercial enterprise is in turn honored by the aid thus rendered to science. In the summer of last year, Professor Encke, following the example set in England, determined successfully by galvanic signals the difference of longitude between Berlin and Frankfort-on-the-Maine. Galvanism has also been applied to astronomical purposes in other ways. The method of observing transits by the intervention of a galvanic circuit, just put in practice in America, in which only sight and touch are employed, and counting is not required, is now in operation at the Greenwich Obser-

vatory. It is found to be attended with more labour than the old method; but as it is free from errors to which the other method is liable, it lays claim to general acceptance. At Greenwich, also, the galvanic circuit is most usefully employed in maintaining the movements of distant sympathetic clocks, and in dropping time-signal balls. A ball is dropped every day at Deal by a galvanic current from the Royal Observatory. Some anxiety was felt by astronomers respecting the continuation of that most indispensable publication, the *Astronomische Nachrichten*, after the decease of the editor, Mr. Petersen, in February last. This has been dispelled by a recent announcement that the King of Denmark has resolved to maintain the Altona Observatory in connection with that of the editorship of that work. The *Astronomical Journal*, an American publication of the same kind, undertaken by a young astronomer and mathematician, Mr. Gould, for the special information of his countrymen, has reached the end of Volume III, and will, it is hoped, be continued. Generally, it may be said of astronomy, at the present time, that it is prosecuted zealously and extensively, active observations being now more numerous than ever, and that the interests of the science are promoted as well by private enterprise as by the aid of Governments. J. CHALLIS."

"Cambridge Observatory, September 14, 1854."

You will have observed that Professor Challis speaks of the activity of private enterprise in the cause of astronomy; and can I in this place pass over the labours of a Lassells, or the enlightened public spirit of the corporation of this town, which, stimulated by your visit in the year 1837, has now for some years maintained an excellent and well-provided Observatory, under the able management of Mr. Hartnup, who has not only conferred great benefits on the navigation of the place by the regulation of its chronometers, but great honour upon the institution by the general services which he has rendered to meteorological, as well as astronomical science? Mr. Hartnup's improvements in the chronometer, by which the errors arising from variations are either corrected or estimated and allowed for, have been of the greatest value. In the words of a report of the Council of the Royal Astronomical Society—"It is found experimentally, that when a captain will apply the rate thus corrected for temperature, the performance of chronometers is much improved;" and in regard to the importance of the subject to the practical interests of navigation, I would take the liberty of quoting further—"There are risks at sea, against which no foresight can provide; but loss from defective compasses or ill-regulated chronometers should be treated as a crime since common sense and common care will secure the efficacy of both these instruments. It is to be feared that life and property, to a large amount, are yearly sacrificed for a want of a little elementary knowledge, and a small amount of precaution on the part of our seamen, who neglect the safeguards furnished by modern science."

You may remember, that at the period of your last meeting, arrangements with Government were in progress for the construction of a reflecting telescope of four-feet aperture, which should bring to bear upon the Nebulæ and other starry phenomena of the southern hemisphere a far higher power than that to which they had been submitted by Sir John Herschel. You will regret to hear that, although the estimate was not objected to by the Government, it has not yet been submitted to Parliament. We must make some allowance for the preoccupations of war.

The labours of your Kew Committee are carried on with unabating assiduity and extending usefulness. You will, perhaps, forgive me for taking the liberty of urging upon you the importance of continuing to them an unabated, if not an enlarged support. By giving accuracy to the various implements of observation,—the thermometer, the barometer, and the standard weights and measures, they are doing a work of incalculable benefit to science in general, in this and in other countries. At this moment they have in their hands for verification and adjustment, 1,000 thermometers, and 50 barometers for the navy of the United States, as well as 500 thermometers and 60 barometers for our own Board of Trade, the instruments which are supplied in ordinary commerce being found to be subject to error to an extraordinary degree. At the suggestion of Sir John Herschel, they have also undertaken, by the photographic process, to secure a daily record of the appearance of the sun's disc, with a view of ascertaining, by a comparison of the spots upon its surface, their places, size, and forms whether any relation can be established between their variations and other phenomena. The Council of the Royal Society has supplied the funds, and the instrument is in course of completion. The same beautiful invention, which seems likely to promote the interests of Science in many branches, at least as much as those of Art, is employed under the able direction of the Committee, and of Mr. Welsh the curator, to record, by a self-acting process, something similar to that of the anemometer, the variations in the earth's magnetism. But I will not pretend to anticipate the results of the careful and extended study of this subject by our able associate, Col. Sabine, who has been kind enough to promise that we shall hear them from his own mouth in one of our evening meetings. Neither will I anticipate the report of my learned and distinguished predecessor in this chair, Mr. Hopkins, on a subject to which he called the attention of the Association at its last Meeting, and on which, in conjunction with Mr. Fairburn and Mr. Joule, he has been engaged in a series of experiments. I allude to the effects of pressure, on the temperature of fusion,—a problem of great importance, as bearing on the internal condition of our planet.

A Report of a Committee of the Institute of France, consisting of MM. Lionville, Lamé and Élie de Beaumont, on the subject of a theory of Earthquakes, has been transmitted to me for the use of the Association. From a careful discussion of several thousands of these phenomena, which have been recorded between the years 1801 and 1850, and a comparison of the periods at which they occurred with the position of the moon in relation to the earth, the learned Professor M. Perrey, of Dijon, would infer that earthquakes may possibly be the result of an action of attraction exercised by that body on the supposed fluid centre of our globe, somewhat similar to that which she exercises on the waters of the ocean; and the Report of the Committee of the Institute is so far favourable that at their instance the Institute have granted funds to enable the learned Professor to continue his researches. You will recollect how often the attention of the Association has been drawn to this subject by the observations of Mr. Milne and of Mr. Mallet, which latter are still going on; and that the accumulating facts are still waiting for a theory to explain them.

On Geology.—I am sorry for the slightness of my acquaintance with so captivating as well as so practical a study. I have nothing to report, save that the increasing scarcity of ironstone and coal is driving the practical men to have greater respect for a science which enables them to form a very sound conjecture where such minerals are likely to be found, and to come to something like an absolute certainty as to where they are not. When the questions begin to be asked, "Is there a square mile in all the coal-fields of Britain unoccupied by the mines?"—"Of its 5,000 square miles of visible coal tract how much remains untouched?"—it is time, indeed, to listen to that science which has taught us so successfully, in the hands of a Murchison, a Phillips, and others, where further resources for the supply of this, the life of Britain, is to be found.

I need hardly tell you of the services which Meteorology may be expected to render to practical life, and perhaps there is no better instance of the value of the accumulation of facts, though in themselves apparently of small importance, and having apparently little connexion with each other.

What apparently can be less subject to rule and law, even to a proverb, than the changeful wind and the treacherous wave? Yet even here, observation and comparison have done some good work for science and for man, and are about to do more. You are all aware that the American Government have now for some years, at the instance and under the direction of Lieut. Maury, been collecting from the mercantile vessels of that nation observations of certain phenomena at sea, such as winds, tides, currents and temperature of the ocean; and that the results, digested into charts and books, have already been the means of adding speed and safety to their voyages in an extraordinary degree.

You are aware that application was made to our Government to cooperate in this great work of common benefit to every mercantile nation, and that the subject was brought before parliament by one of our Vice-Presidents, Lord Wrottesly, in a speech which he has since published, and which I would commend to every one's perusal who doubts of the importance of this branch of science to the interests of commerce and navigation. You are perhaps not aware that the Government has agreed to the proposal, and has created a special department for the purpose, in connexion with the Board of Trade, placing it under the management of perhaps the one man best fitted to carry it out with energy and success, my friend Capt. Fitzroy, one not less known on the banks of the Mersey by old associations, than on the general fields of maritime science. Conceiving that this was a subject of special interest to the place of our present Meeting, and that for such an object it was desirable as publicly and as widely as

possible to solicit the co-operation of all who are connected with the commerce of the country, I have asked Capt. Fitzroy to communicate to me the present condition of the question; and he has kindly furnished me, not officially, with the following memoranda, which, with your permission, I will read:—

"*Memorandum I.*—The maritime commerce of nations having spread over the world to an unprecedented extent, and competition having arrived at such a point that the value of cargoes and the profits of enterprise depend more than ever on the length and nature of voyages, it has become a question of the greatest importance to determine the best tracks for ships to follow, in order to make the quickest as well as the safest passages. The employment of steamers in such numbers,—the general endeavour to keep as near the *direct* line between two places (the arc of a great circle) as the intervening land, currents, and winds will allow—and the improvements in navigation, now so prevalent, have caused a demand for more precise and readily available information respecting all frequented parts of the oceans. Not only is greater accuracy of detail required, but much more concentration and arrangement of very valuable, though now scattered, information. Besides which, instrumental errors have vitiated too many results, and have prevented the greater portion of the meteorological observations hitherto made at sea from being considered better than approximations. 'It is one of the chief points of a seaman's duty,' said the well known Basil Hall, 'to know where to find a fair wind, and where to fall in with a favourable current:' but, with the means at present accessible, the knowledge of such matters can only be acquired by years of toil and actual experience, excepting only in the greater thoroughfares of the oceans, which are well known. Wind and Current Charts have been published of late years, chiefly based on the great work of the United States Government, at the suggestion of, and superintended by, Lieut. Maury; and by studying such charts and directions, navigators have been enabled to shorten their passages materially. In many cases as much as one-fourth, in some one-third of the distance or time previously employed. Much had been collected and written about the winds and currents by Rennell, Capper, Reid, Redfield, Thom, Piddington, and others; but general attention was not attracted to the subject, however important to a maritime country, till the publication of Lieut. Maury's admirable observations Encouraged by the practical results obtained, and induced by the just arguments of that officer, the principal maritime powers sent duly qualified persons to assist at a conference held at Brussels last year on the subject of Meteorology at sea. The report of that Conference was laid before Parliament, and the first direct result of it was a vote of money for the purchase of instruments and the discussion of observations. All the valuable meteorological data which have been collected at the Admiralty, and all that can be obtained elsewhere, will be tabulated and discussed in this new department of the Board of Trade, in addition to the continually accruing and more exact data to be furnished in future. A very large number of ships, chiefly American, are now engaged in observations; stimulated by the advice, and aided by the documents so liberally furnished by the United States Government, at the instance of Lieut. Maury, whose labours have been incessant. Not only does that Government offer directions and charts gratis to American ships, but also to those of our nation, in accordance with certain easy and just conditions.. In this country the Government, through the Board of Trade, will supply a certain number of ships which are going on distant voyages with 'abstract logs' (or meteorological registers), and instruments gratis, in order to assist effectively in carrying out this important national undertaking. In the preface to a late edition of Johnston's 'Wind and Current Charts,' published last June at Edinburgh, Dr. Buist says,—'It has been shown that Lieut. Maury's charts and sailing directions have shortened the voyages of American ships by about *a third.* If the voyages of those to and from India were shortened by no more than *a tenth,* it would secure a saving in freightage alone, of £250,000 annually. Estimating the freights of vessels trading from Europe with distant ports at £20,000,000 a year,—a saving of a tenth would be about £2,000,000; and every day that is lost in bringing the arrangements for the accomplishment of this into operation occasions a sacrifice to the shipping interest of about £6,000, without taking any account of the war navies of the world.' It is obvious that, by making a passage in less time, there is not only a saving of expense to the merchant, the ship-owner, and the insurer, but a great diminution of the risk from fatal maladies,—as, instead of losing time, if not lives, in unhealthy localities, heavy rains, or calms with oppressive heat, a ship properly navigated may be speeding on her way under favourable circumstances. There is no reason of any insuperable nature why every part of the sea should not be known as well as the land, if not indeed better than the land, generally speaking, because more accessible and less varied in character. Changes in the atmosphere, over the ocean as well as on the land, are so intimately connected with electrical agency (of course including magnetism), that all seamen are interested in such matters,—and the facts which they register become valuable to philosophers. Meteorological information collected at the Board of Trade will be discussed with the two-fold object in view—of aiding navigators, or making navigation easier, as well as more certain,—and amassing a collection of accurate and well-digested observations for the future use of men of science.

"*Memorandum II.*—As soon as the estimate for meteorological expenses had passed, steps were taken to organise a new branch department at the Board of Trade. On the 1st of August, Captain Fitzroy was appointed to execute the duties of this new office, referring to Dr. Lyon Playfair, of the department of science and art, and to Admiral Beechey, of the marine department, for such assistance as they could render. As soon as registers and instruments are ready, and an office prepared, Captain Fitzroy will be assisted by four or five persons, whose duties he will superintend. It is expected that several ships will be supplied with 'abstract logs' (meteorological registers) and instruments in October, and that the office will be in full work next November. The Admiralty have ordered all the records in the Hydrographical Office to be placed at the disposal of the Board of Trade for a sufficient time. All other documents to which Government has access will be similarly available; and the archives of the India House may likewise be searched. There will be no want of materials, though not such as would have been obtained by using better instruments on a systematic plan. Captain Fitzroy ventures to think that the documents hitherto published by Lieutenant Maury present too much detail to the seaman's eye; that they have not been adequately condensed; and therefore are not, practically, so useful as is generally supposed. His Instructions, or Sailing Directions (the real condensed results of his elaborate and indefatigable researches), have effected the actual benefits obtained by mariners. Reflecting on this evil, which increasing information would not tend to diminish, Captain Fitzroy proposes to collect all data, reduced and meaned (or averaged) in a number of conveniently arranged tabular books, from which, at a subsequent period, diagrams, charts, and 'meteorological dictionaries,' or records, will be compiled, so that, by turning to the latitude and longitude, all information about that locality may be obtained at once, and distinctly."

I cannot doubt that the spirited merchants and shipowners of England will not be slow to follow the example of their brethren in the United States, and will lend their heartiest assistance to a work so useful. Great facilities will be afforded them in the way of instruments of tested accuracy; and the increasing number of scientific seamen, which is resulting from the local institutions of education, and the system of examination of masters and mates for certificates, will furnish them with observers in every part of the ocean, fit to be intrusted with such instruments and skilful in their use. Let not the practical man think lightly of such matters when he is reminded of the great services of the barometer in forewarning of the coming storm, that the ascertained temperature of the sea which his ship is traversing, will inform her master whether he is engaged in one current or another, and announce to him the approach of the dangerous iceberg, when it is not discoverable by any other means.

I will now, with your permission, proceed to the consideration of some other departments of our work, such as geography, ethnography, and statistics, which are more connected with my own pursuits, which, affected as they are by the character of man, the uncertainties of his will, and the accidents of his physical and moral nature, and thus being less the subjects of direct and pure experiment, seem at first sight to be hardly reducible to those fixed laws which it is the object of science to investigate and ascertain. For these reasons, indeed, among others, these branches of study formed at first no part of the scheme of the British Association, and there was some doubt about their subsequent admission.

Nevertheless, I rejoice that they were so admitted. The apprehension that they must introduce the spirit of party into our proceedings has been most honourably disappointed; and as one, who, in the capacity of a member of the Legislature, has to act from time to time on the subject of some of their inquiries, I cannot but express my gratitude for the assistance which they have afforded, both by informing and forming the public mind on many important questions; and above

all, for the lesson they have taught on the importance of testing every theory by a patient collection and impartial discussion of the facts; in a word, for having imported the spirit of science into what, in the largest sense of the word, may be called politics, instead of importing the spirit of politics, in its narrower sense, into science.

What is more importent than to rescue questions of this nature, such as Finance and Political economy, for instance, in some degree at least, from the domain of party contention? And how can we better contribute to that desirable result, than by discussing the carefully collected facts in a scientific spirit on an arena within which no party spirit is excited, no party allegiance is acknowledged, no party victory has to be lost or won, and when men are at liberty to convince or be convinced without risking a charge of treachery or a change of ministry as the consequence? But, in fact, these studies could not fairly have been excluded from our peripatetic university of science.

Who shall separate Political altogether from the influences of Physical Geography, or Ethnology from Physiology, or the destinies of man upon this globe from the study of his physical nature? By its employment of the doctrine of probabilities, one branch of statistics is brought into immediate contact with the higher mathematics, and the actuary is thus enabled to extract certainty in the gross out of uncertainty in the detail, and to provide man with the means of securing himself against some of the worst contingencies to which his life and property are exposed. In fact, statistics themselves are the introduction of the principle of induction into the investigation of the affairs of human life;—an operation which requires the exercise of at least the same philosophical qualities as other sciences. It is not enough in any case merely to collect facts and reduce them into a tabular form. They must be analyzed as well as compared; the accompanying circumstances must be studied (which is more difficult in moral than in material investigations), that we may be sure that we are (that is to say, in reality calling the same things by the same names) treating of the same facts under the same circumstances; and all disturbing influences must be carefully eliminated before any such pure experiment can be got at as can fairly be consi ered to have established a satisfactory conclusion. In some cases this is easier than in others. In regard to the probabilities of life or health, for instance, there are, at least, no passions or prejudices, no private interests at work, to interfere with the faithful accumulation of the facts, and if they be numerous enough, it might bo supposed that their number would be a sufficient protection against the effect of any partial disturbances. But even here, caution, and special, as well as extensive knowledge, are required. There are disturbing influences even here,—habits of life, naturo of employment, immigration or emmigration, ignoranco or mis-statement of age, local epidemics, &c., which leave sources of error, in even tho most extended investigations. Still results aro attained, errors are more aud more carefully watched against, and allowed for, or oxcluded, and more and more of certainty is gradually introduced. And hero I should not omit to notice the valuable services of tho Society of Actuaries, not long ago established, and who are represented in our statistical section. They discuss all questions to which the science of probability can be applied; and that circle is constantly extending—assurance in all its branches, annuities, reversionary interests, the laws of population, mortality, and sickness; they publish transactions; and what is of the greatest importance in this, as indeed in any branch of inductive scieuce, they hold an extensive correspondeuce with foreign couutries. In fact, they are doing for the contingencies of human life, and for materials apparently as uncertain, something like what meteorology is doing for the winds and waves.

What shall I say to the statistics of crime, of education, of pauperism, of charity, at once and reciprocally the effect and the cause of that incroasing attention to the condition of the people, which so favorably distinguishos tho present age? Who can look at tho mere surface cf society, trausparently betraying tho abysses which yawn beneath, and not dosiro to know something of their secrets, to throw in the moral drag, and to bring to the light of day some of the phenomena, tho monstrous forms of misery and vice which it holds withiu its dark recesses? and who can look at these things, no longer matter of conjecture, but ascertained, classed, and tabled, without having the desire awakened or strengthened to do something towards remedying the evils thus revealed, and without feeling himself guided and assisted towards a remedy? Yet here, more than in other cases, should a man suspect himself; hero should he guard himself against hasty conclusions, drawn from the first appearance of the results; for here are disturbing influences most busily at work, not only from without, but from within—not only in tho nature of the facts themsolves, but in the feelings, passions, prejudices, habits, and moral constitution of the observer.

Still, the tabling of the facts is of infinite importance. If they disturb, as they are sure to do, some feeling, some prejudice, some theory, conviction, it will be felt, that anyhow the facts have to be accounted for; further investigation will follow; and if it appear that no correction is required, the truth will be established, and the hostile theory will, sooner or later, give way and disappear. In these things it is, of course, more than usually important that the facts to be selected for collection should be such as are, in their own nature, and under the circumstances, likely to be ascertained correctly, and that the business of collection should be in the hands of those who have no bias to do it otherwise that fairly, no interest in the result: and this was, I believe, kept studiously in view by those who had the management of our great statistical work, the recent Census of our own country, which we are still studying; but, whether they were successful or not, in this respect, has already become matter of discussion.

The work itself is, doubtless, one of the greatest monuments that has ever been presented to a nationi as a record of its own constituent elements and conditiou; compiled and commented on with singular industry, ju lgment, acuteness and impartiality,—the Domesday-book of the *people* of England, as the great volume of the Conqueror was of its *surface*.

Nor can I, while speaking of statistics, avoid referring to the Statistical Congress which took place at Brussels, about this time last year; which had mainly for its object to produce uniformity among different nations in the selection of the facts which they should record, and in the manner of recording them; without which, indeed, no satisfactory comparisons can be established, no results can safely be deduced. To bring about such an uniformity absolutely is, I am afraid, hopeless; inasmuch as the grounds of difference are, in many cases, so deeply imbedded in the laws, the institutions, and the habits of the different countries, that no hammer of the statist is likely to remove them.

To understand, however, the poiuts of difference, even if they are not removed, is, in itself, one great step towards the object. It at least prevents false conclusions, if it does not fully provide the means of establishing the true ones. It gets rid of sources of error, even if it fail of giving the full means of ascertaining truth. Take, for instance, the case of criminal statistics. We wish to ascertain the comparative prevalence of different crimes, either at different times or in different countries. For this purpose must we not know uuder what heads the jurists and statists of the times or countries to be compared array the various offences which are recorded; with what amounts of penalty they were visited; and with what rigour, from time to time, the penalties were enforced?

That which is called manslaughter in one country, and assassination in another, is called murder in a third. That which in one country is punished with death, in another is visited by imprisonment. The bankruptcy which in one country is a crime, in another is a civil offence. The juvenilo offences which in one country are punished by imprisonment, and swell the criminal calendar, in another are treated, as they should in many cases be, only as a subject of compassion and correction,—take no place in the criminal calendar at all.

Indeed, it is one of the difficulties which beset a large propertion of these investigations, whether into morals, health, education, or legislatiou, and which must always distinguish them from those which deal either with matter or defined abstractions, that, in using the same terms, we are often uncertain whether we mean the same thing; whether, in fact, when we are usiug the same denominations the same weights and measures are really employed. Such conferences, however, as those of Brussels tend much to limit the extent of error.

Among the objects which may best occupy the attention of the Statistical Section, at the present moment, will be the discussion of a decimal coinage, and the statistics of agricultural produce. It is important in regard to both, that by previous sifting and discussion not only tho best conclusions should be arrived at, but the subject should be so familiarized to general apprehension as to secure the widest cooperation. In regard to a change in the coinage, the interests and feelings of the lower classes must be especially consulted; and, with this view, without expressing any ultimate opinion, I would recommend to those who are considering the question, the perusal of a pamphlet, full of important matter, by the late Mr. Laurie, the work of tho last hours of a man of eminent knowledgo and virtue, which he

had hoped to be able to communicate in person, as a paper, to the present Meeting. With regard to the statistics of agriculture, the main object is to procure such knowledge of the facts as shall guide the operations of the consumer and the merchant. I would suggest that they should be taken and published at two periods of the year, once in the spring, recording the extent of soil devoted to each kind of grain,—a fact easily ascertained; the second time as soon as the harvest is concluded,—announcing the amount of the crop, as ascertained on several specimen fields under different circumstances of soil and climate, and applying it in due proportion as a multiple to the acreage already published. A really accurate census of the harvest is, I believe, impracticable, at least within the period which would alone make it valuable for present use; and the approximation which I have suggested would, I conceive, be adequate to the purpose.

In regard to Geography and Ethnography, there are few sections, I believe, which have more general interest, and none, I imagine, which would be more attractive here,—where every new discovery is connected with the material interests of the place, a new source of raw material, or a new destination for finished work; and where every new communication, established and reported, is another channel for the extension of that commerce, which, bursting from the channels of the Mersey, permeates and percolates every creek and cranny of the known world.

The great navigations which are opening up the heart of the South American continent, by the Paraguay, the Amazons, and the Orinoco; that are traversing and uniting the colonies of Victoria and South Australia by the river Murray; the projected exploration of North Australia, which, I am sorry to say, is as yet only a project, and may require some of the fostering warmth of the Association to bring it into actual existence; the wonderful discoveries in South Africa, by Livingston and Anderson—(I am happy to say that Mr. Anderson is here to tell his own story),—and the explorations of central Africa, by Barth and Vogel; the pictures given us by Capt. Erskine and others of the condition of the islanders of the South Pacific, passing in every stage of transition from the lowest barbarism to a fitness for the highest European and Christian culture; these, and a hundred other topics, awaken an ever new interest in the mind of the philosopher and statesman, in the feelings of the Christian and the lover of his kind. What new fields for science! What new opportunities for wealth and power! What new openings for good! How important that those who issue from this great emporium of modern commerce—this more than Tyre of modern times—should know how to turn them to advantage! Surely your periodical visits here, with their kindling, stimulating—I was going to say infections—influences are no mean instrument for such a purpose.

It cannot be for nothing that the heroes of every branch of science are assembled from many countries within these walls, and are brought into personal contact with the most enterprising and public-spirited of our merchants; that, in the language of my distinguished predecessor in this chair, slightly adapted, "the counting-house is thus brought into juxtaposition with the laboratory and the study." Commerce will more than ever be auxiliary to science—and science more than ever the helpmate of commerce—and a still further impulse will be given to those beneficial influences, which, in spite of some painful, though necessary interruption, occasioned by our present state of war, a good Providence is so visibly extending over the whole habitable globe.

It is happily becoming every year less and less necessary to press these things on public notice. In an age of gas and steam—of steam-engines and steamboats—of railroads, and telegraphs, and photographs—the importance of science is no longer questioned. It is a truism—a commonplace. We are far from the foundation days of the Royal Society,—when, in spite of the example of the monarch, their proceedings were the ridicule of the Court; and even the immortal Butler thought the labours of a Wallis, a Sydenham, a Harvey, a Hooke, or a Newton, fit subjects for his wit.

It is still, however, worth inquiring whether sufficient facilities for education in science exist or are in progress in our country; and whether Government and other important bodies provide sufficient encouragement and reward for its prosecution.

Now, in regard to the former, there can be no doubt that, until a very late period, the assistances to scientific education furnished in this country, either by educational institutions or the State, were very slight, and totally unworthy of the object or the nation. Look at the lower schools: until very lately nothing but reading and writing, and hardly that, was ever offered to the labouring classes. Look at the grammar schools: they were limited to the acquisition of a small modicum of Greek and Latin, often not even of arithmetic. The middle classes of society, those who did not send their children to the Universities, had no opportunity of acquiring any, the slightest, knowledge of science, whether practical or abstract, from the untested, ill-respected teachers in private commercial schools, or from the casual visit of an itinerant lecturer with his travelling apparatus. But what did the Universities? My own University, Oxford, to which I acknowledge in other respects the highest obligations, did little for physical science. True, that the study of Mathematics, as an exercise and training of the understanding, received its honours there, though the genius of the place has never yet been favourable to the pursuit. True, that until comparatively a recent period, the honours of the sister University were exclusively, or nearly so, confined to the same science; and that the school of Newton has seldom been without names not unworthy of such a founder. But even there the Mathematics were still too exclusively regarded as a mere training of the understanding, and not as an instrument for the discovery of further truth; and the fair tree of science, planted within the academic courts, though healthy and vigorous, was somewhat barren of fresh fruit. Such as it had been in the time of Newton, such, in a great degree, for a century and a half, at least, it remained. But to other than mathematical science, I believe I may say at either University encouragement there was little or none. If now and then a professor was to be found whose title promised something of the kind, on approaching him you would find that his existence was little more than nominal; that his courses were not frequented, even if they were offered,—or if at all only by those who were considered rather as the idle men; because success in them was not only no advantage in the University career, but, by the time which they abstracted from the rewarded studies, was a positive loss and obstruction in the way of the honours and emoluments of the place. So that it might fairly be said, that if any advance was made in such sciences, at least in the Universities of England, it was rather in spite of than by reason of the system pursued in those otherwise useful, noble and magnificent institutions. In Scotland, indeed, the extended study of medicine, connected as it is with so many other branches of science, together with the less amount of artificial forcing into other studies, led naturally to the pursuit of physical science, and a Black and a Gregory, a Leslie, and a Playfair had no rival contemporary names at Oxford and Cambridge. The names of a Whewell and a Herschel, an Airy, a Challis, and a Sedgwick, of a Powell and a Daubeny, and a Buckland,—alas that he is only a name now—would forbid the assertion in regard to more recent times. But what, meanwhile, was the State doing? That State which, with its limited population and territory, depends not upon the number of its people, but upon the individual value of each man,—not upon the number of its acres, but upon their skilful cultivation,—not even upon the resources of its surface, however well developed, but upon the mines which lurk beneath it,—not even upon its mines but upon all the various and varying manufactures, which these mines give extraordinary facilities for carrying on; not even on these manufactures, but on the extended commerce and navigation, which are necessary to provide the materials to draw them forth from the remotest corners of the earth, and to send them back with speed, safety and economy, in another form and combination, often to the very spots from which they were derived;—in a word dependent for the full development of its agriculture, its mining industry, its manufactures and its commerce, upon the widest extension and the fullest cultivation of Chemistry, of Natural History, of Mineralogy, of Geology, of Astronomy, of Meteorology and Mechanics. What did the State do for these things? Why, absolutely nothing. There was for a time a Board of Longitude, which instead of enlarging and improving, it abolished; a Board of Agriculture, which it dropped; a School of Naval Architecture, which, at the bidding of a narrow economy, and at the instance of practical men, it abolished when the fruits were ripening; a School of Naval Instruction, at Portsmouth, which it dropped. Here and there still survives a grant from the bounty of an individual monarch, grudgingly adopted by the State,—of £10 for a Professor of Natural Philosophy at Aberdeen, or 50 guineas for a similar Professor at St. Andrews, or £150 to one at Glasgow, or £30 to one at Edinburgh, and more recently, grants of £100 a year each to four or five Professors in each of the old Universities of England. This is, as far as I can discover, all that the magnificent State of Britian did, until recently, for that Science on which her wealth,—and if her wealth, her power,—and if her power her very existence,—is dependent. True, one advantage we have enjoyed,

which is indeed worth all the organized instruction in the world which despotism could offer,—"although no science fairly worth the seven," —we have enjoyed security for life and property; the free exercise of thought and action; religion, which does not chain the energies of mind and character, but stimulates and exercises, while it regulates and directs them; and though last, not least, a country to be proud of, and to be fond of, and which every one desires to bequeath to his posterity better, more beautiful, and stronger, than he found it. And it is by reason of this indirect influence on national character, that, in spite of the more than want of encouragement of science of which our Government has been guilty, England has yet to boast of an array of men of science, of workers and discoverers, if not always of teachers, such as she need not be ashamed to show by the side of any other country, whatever stimulants or encouragements its Government may have supplied.

But because so much has been done by the spontaneous vigor of the people's character and of their political and religious institutions, without special assistance or encouragement, does it follow that still more would not be done with those aids? Such, happily, is not the opinion of the present day—not the opinion of the legislature—not that of the Universities themselves. We do not believe that such difficulties are an advantage even to the vigour of the plant, still less to its extended propagation; and accordingly, individuals, colleges, and, I hope, Governments, are now heartily and honestly engaged in repairing the defect of centuries, and not only in promoting the general development of intellect, but especially in directing it to the fields of science. And, happily, the facilities for the purpose already at hand are enormous. The Chancellor of the Exchequer need not apprehend excessive demands upon his treasury to meet the case; though, if they were necessary, I believe he is too sensible a man to withhold them; but such demands are not required. The encouragements and assistances already given by the State to the education of the people, in various shapes; the superior class of trained and examined teachers, who are spreading over the land, and whose training has in no small degree been in physical science; the books provided for early education by our societies and by individual enterprise having the same character; the every-day more and more acknowledged connexion between agriculture and science, showing itself in such papers as enrich the pages of the Journal of the Royal Agricultural Society; the establishment of the department of science, with its school of mines, under the Board of Trade; the improvement which is to be expected, under the action of the charity commissioners, in the system of our old grammar schools; the spontaneous action of our old Universities, not superseded, but facilitated and stimulated by parliamentary interposition. These and such like changes, which are taking place, partly within the bosom of society itself, and partly by the action of Government, will shortly provide such means of scientific education, although not systematised with the exactness of continental organisation, as will, after our rough English fashion, adequately provide for all our wants in that respect, and give us no cause to lament over any considerable deficiencies in practical result.

But will there be encouragements to make use of these facilities? Are there rewards in prospect, whether of direct emolument or social consideration, which will induce men "to wear out nights, and live laborious days," in a service which has hitherto, in the world's eye at least, appeared often to be ill requited? Now, the real stimulant to science has at all times been the delights of the pursuit itself, and the consciousness of the great services rendered to humanity by every conquest within the domain of truth; but still these questions may fairly demand an answer. To the questions of pecuniary rewards I will presently advert, they have certainly been miserably inadequate; but in regard to social consideration, I think there has existed some misunderstanding. It has been often asserted, and made the subject of lamentation or complaint, that men of science do not enjoy in this free country, the consideration which they do in some countries less favored otherwise in their institutions than ourselves. Now, if by this it is intended to express, that men of science are not made Knights of the Garter or Peers of Parliament—that they are not often met with in the haunts of wealth and fashion—that they are not called into the councils of their Sovereign, or sent to represent her in foreign Courts, I admit the fact; but, then, I doubt whether these are the natural or fitting objects of ambition to the scientific man; and if it is intended by the assertion that they are not, as a class of individuals, appreciated by their fellow-citizens for their genius and honored for their services, I cannot so fully admit the fact. I would ask any of those whose presence adorns is meeting, do they not find that their names are a passport into any society, the proudest of the land? Whose doors, that are worth entering, are not open to them? There are certain advantages, superficially considered, which will always belong to mere wealth or power; but are they such as the lover of science can bring himself to envy or desire? Wherever he is known, he is honoured—witness in themselves the meetings of this great Association, and of other kindred bodies, who visit, from time to time, different quarters of our land: where is their presence not hailed, not struggled for? Where is it not the endeavour of rank and wealth on every such occasion to do honour to itself by showing honour generally and personally to those who, by their successful pursuit of science, have done honour to our own or foreign lands? If, indeed, there be anything yet wanting in this respect, either in our people or our Government, the progress of education in science, to which I have before alluded, will soon supply it when the various classes of our population, in their schools, their mechanics' institutes, and, not least, in their colleges, are themselves less ignorant of science; when they have learnt to appreciate its value by personal acquaintance with its truths, there is no fear that those at whose feet they have sat—whose names are familiar to them in association with so valuable an acquisition—will not receive all due honour and regard. Whether, or to what extent, the result will be a greater association of science with political position, and how far such association would be advantageous to either politics or science is another question. The experience of foreign countries on this head can hardly be held to be quite satisfactory. I am not sure that their men of science have been very successful politicians, or that science itself has profited by the union. Public life, more than science, is a jealous mistress, and does not well tolerate a known devotion to any other pursuit. It has besides a science of its own, essential to it, especially in a free country,—the knowledge of men; and this is not always the special gift of men of science, who deal less with men than with things and thoughts; and I am not sure that the qualities which fit a man for success in the one pursuit, are peculiarly advantageous to him in the other. This, however, is certain,—that those who administer the affairs of this country ought at least (I do not think as yet they do) to know enough of science to appreciate its value, and to be acquainted with its wants and with its bearings upon the interests of society; but such knowledge, I cannot doubt, will soon become the common apanage of all well-educated men: and when it is so, as I said before, whatever, either in the position of science, or of men of science, is still wanting, will soon be supplied.

To accelerate, however, this process, I would gladly see a more direct communication established between the organs of power and scientific bodies. Something in this respect has already been done by the Parliamentary Committee of this Association, and the results have been already seen in the increased attention of Parliament and Government to scientific objects. Still, however, in regard to science, I must admit that there is one great deficiency. For often may it be said of science, as it was said satirically of virtue by the poet, *laudatur et alget*,—It is praised and starves. The man of science may not desire to live luxuriously; he may not, nor ought he, desire to rival his neighbours in the follies of equipage and ostentation, which are often indeed, rather imposed by the customs of society than an advantage or even a gratification to the parties themselves; but he must live, and for the sake of science itself he ought to be able to live, free from those anxious cares for the present, and the future, or from the calls of a profession, which often beset and burden his laborious career. Why was our Dalton compelled to waste the powers of such an intellect on private teaching? As a teacher, a physician, or a clergyman, or more rarely as a partner in a profitable patent, such a man may earn a competence, and give to science the hours which can be spared from his other avocations; and it is indeed astonishing what results have been the produce of these blessings of a laborious life,—these leisure hours, if so they may be called, of men who are engaged in arduous duties of another kind. But this ought not to be: and it will not long be, I am confident. It must give way before the extended cultivation of science itself. The means of occupation in connexion with our schools and our colleges, and our examinations, will increase; and I cannot but hope that a grateful country will insist upon her benefactors in science receiving a more liberal share of her bounty than has hitherto been allotted them. If I recollect right, out of the £1,200 which are annually appropriated in pensions to the successful cultivators of science, literature and art, a poor pension of £50 is all that last year fell to the lot of science; and in former years the disproportion has often been little less remarkable. I do not grudge their share to Literature and Art; but I confess I cannot but consider that the labours of

Science are at least of equal value to a nation's welfare; that they have at least an equal claim upon her gratitude, and I am sure that they stand in no less need of encouragement and support.

Nor have I any fear that the study of Science should ever become too exclusive, that is, should make us too material, that it should overgrow and smother those more ethical, more elevating influences which are supposed to grow from the pursuit of Literature and Art.

In the first place, the demands of Science upon the patient and laborious exercise of thought are too heavy, too severe, to make it likely that it should ever become the favorite study of the many. In Art and Literature, the mind of the student is often comparatively passive, in a state of almost passive enjoyment of the banquet prepared for him by others; in those of Science the student must work hard for his intellectual fare. He cannot throw up his oars,

And let his little bark, attendant sail,
Pursue the triumph and partake the gale,

but he must tug at the oar himself, and take his full share in the labour by which his progress is to be made.

Nor, indeed, when I read the works of a Whewell, and a Herschel, and a Brewster, a Hugh Miller, or a Sedgwick, and a hundred others the glory of our days, can I see any reason for apprehending that the study of Science deprives the mind of imagination, the style of grace and beauty, or the character of its moral and religious tone, its elevation and refinement.

And, now, ladies and gentlemen, I have done. Once more assuming for a moment the character of a representative of this great town, I welcome you, the British Association, a second time to Liverpool. It is right that you and Liverpool should have frequent meetings, and should cultivate an intimate acquaintance. There is no place which can do more for science if she pleases; none has opportunities so extensive of becoming, by her ships and commercial agencies, by her enterprising spirit and connexion with every soil and climate, the missionary of science,—perhaps I should rather say, the importer of the raw material of facts and observations,—the exporter of the manufactured results arising from their scientific discussion. There is no town which owes more to science. Without science can her vessels stir without danger out of sight of land, or walk the waters independent of wind or tide? Without science would they have docks to shelter them, railroads to bring their produce to their docks, telegraphs to announce their movements, manufactures to freight them to distant lands? I do not believe that Liverpool is insensible to her obligations. This magnificent reception is one evidence of the feeling,—but a still better is to be found in her liberal support to such institutions as the Public Libraries and Museums, as her Collegiate Institution, and above all, to her magnificent Observatory.

Again I welcome the British Association for the Advancement of Science to the walls of Liverpool, fully assured as I am of the great benefits, direct and indirect, which their presence will confer upon the town, and of the deep sense which, I know the inhabitants entertain of the honour conferred upon them by this repeated visit.

Fate of Sir John Franklin.

DR. RAE'S LETTER TO SIR GEORGE SIMPSON.

York Factory, 4th August, 1854.

MY DEAR SIR GEORGE,—Your several letters, public and private, of dates 15th June, and 1st December, 1853, and 13th and 16th June, 1854, were handed me on the 28th ultimo, on my reaching Churchill, and I rejoiced to learn that your health had benefited so much by your visit to the north.

Let me now allude to the Expedition affairs, I arrived here on the 31st ult. with my small party, in excellent health, but I am sorry to say without having effected our object. At the same time, information has been obtained and articles purchased from the natives, which places the fate of a portion, if not all of the then survivors of Sir John Franklin's miserable party beyond a doubt—a fate the most deplorable—Death from starvation, after having had recourse to cannibalism as a means of prolonging life.

I reached my old quarters at Repulse Bay, on the 15th August, and preparations were immediately commenced for wintering. On the 1st September I explained to the men our position, the stock of provisions we had on hand, (not more than 3 months rations), and the prospects we had of getting more, &c., &c., pointing out all the danger and difficulty of our position. All readily volunteered to remain, and our exertions to collect food and fuel went on with unabated energy. By the end of September, 109 deer, 4 musk ox, 53 brace of Ptarmigan, and one seal had been shot, and the nets produced 190 salmon.

Of the larger animals above enumerated, 49 deer and the musk ox were shot by myself, 21 deer by Mistegan, (the deer hunter), 14 by one of the men, 9 by Ouligbuck and 16 by the other four men. The migration of the deer terminated about the middle of October, and 25 animals were added to our stock.

On the 28th of October, the snow being sufficiently hard for building, we were happy to exchange our cold tents for the more comfortable shelter of the snowhouses. The winter was very severe, but the temperature in our snow-huts was never so low as in my winter quarters of 1846-7. Up to the 12th January we had nets set under the ice in the lakes, the nets were taken up on that date as they produced nothing.

On the 31st of March my spring journey commenced, but in consequence of gales of winds, deep and soft snow, and foggy weather, we made but very little progress. We did not enter Pelly Bay until the 17th. At this place we met with Esquimaux, one of whom, on being asked if he ever saw white people, replied in the negative, but said that a large party, (at least 40 persons) had perished from want of food, some 10 or 12 days' journey to the westward. The substance of the information, obtained at various times and from various sources, was as follows:—

In the spring, four winters past, (spring, 1850) a party of white men, amounting to about forty, were seen travelling southward over the ice, and dragging a boat with them, by some Esquimaux who were killing seals on the north shore of King William's Land, which is a large island named Kei-ik-tak, by the Esquimaux. None of the party could speak the native language intelligibly, but, by signs the natives were made to understand that their ships or ship had been crushed by ice, and that the "whites" were now going to where they expected to find deer to shoot. From the appearance of the men, all of whom, except one officer, (chief), looked thin, they were then supposed to be getting short of provisions, and they purchased a small seal from the natives.

At a later date, the same season, but previous to the disruption of the ice, the bodies of about thirty white persons were discovered on the continent, and five on an island near it, about a long days' journey, (say 35 or 40 miles) to the N. W. of a large stream, which can be no other than Back's Great Fish River, (named by the Esquimaux, Out-koo-hi-ca-lik), as its description, and that of the low shore in the neighbourhood of Point Ogle and Montreal Island agree exactly with that of Sir George Back. Some of the bodies had been buried, (probably those of the first victims of famine), some were in a tent or tents, others under a boat that had been turned over to form a shelter, and several lay scattered about in different directions. Of those found on an island one was supposed to be an officer, as he had a telescope strapped over his shoulder and his double-barrelled gun lay underneath him.

From the mutilated state of many of the corpses, and the contents of the kettles, it is evident that our miserable countrymen had been driven to the last resource—cannibalism—as a means of prolonging life.

There appears to have been an abundant stock of ammunition, as the powder was emptied in a heap on the ground by the natives, out of the kegs or cases containing it, and a quantity of ball and shot was found below high water mark, having been left on the ice close to the beach. There must have been a number of watches, telescopes, compasses, guns, (several double-barrelled) &c., all of which appear to have been broken up, as I saw pieces of these different articles with the Esquimaux, and together with some silver spoons and forks, purchased as many as I could obtain. A list of the most important of these I inclose, with a rough pen-and-ink-sketch of the events, and initials on the forks and spoons. The articles themselves shall be handed over to the Secretary of the Hon. Hudson's Bay Company on my arrival in London.

None of the Esquimaux with whom I conversed had seen the "whites," nor had they ever been at the place where the dead were found, but had their information from those who had been there, and those who had seen the party when alive.

From the head of Pelly Bay,—which is a bay spite of Sir H. Beaufort's opinion to the contrary.—I crossed 60 miles of land in a westerly direction, traced the west shore from Castor and Pollux River to Cape Porter of Sir James Ross, and I could have got within 30 or 40 miles of Bellot Strait, but I thought it useless proceeding further as I could not complete the whole.

Never in my former Arctic journeys had I met with such an accumulation of obstacles. Fogs, storms, rough ice, and deep snow we had to fight against. On one occasion we were 4½ days unable to get a glimpse of the sun, or even to make out his position in the heavens. This, on a level coast, where the compass was of little or no use, was perplexing in the extreme.

The weather was much finer on our return journey than when outwards bound, and our loads being lighter, our days' marches were nearly double the distance, and we arrived at Repulse Bay on the 26th May, without accident, except in one instance, in which one of the party lost a toe from a frost bite.

The commencement of spring was very fine, but June and July were colder. We were unable to get out of the bay until the 6th of August.

Our progress along the coast as far as Cape Fullerton, was much impeded by ice; but on getting to the southward of the cape we had clear water, and saw no ice afterwards.

The conduct of the men, I am happy to say, was, generally speaking, good: and we had not a single case of sickness all the time of our absence.

Being anixous to send this to Red River by the first boats, I write in haste and briefly, but shall have the pleasure of sending a more detailed account by some future opportunity.

With the utmost respect,

I have the honour to be,

Your very obedient servant,

JOHN RAE.

LIST ENCLOSED IN DR. RAE'S LETTER.

CRESTS.

No. 1—Head of (apparently) a Walrus or Sea-horse, with dragon's wings.
No. 2—A Griffin, with wings and forked tongue and tail.
No. 3—A Griffin's head with wings.
No. 4—A Dove with olive branch in its bill, surrounded by a scroll, with the motto, *Spero meliora.*
No. 5—A Fish's Head, with (apparently) coral branches on either side.

List of Articles purchased from the Esquimaux, said to have been found to the West, or rather N. W. of Back's River, at the place where the party of men starved to death in Spring, 1850.

1 silver table fork,	Crest No. 2
3 do. do. do.	" " 1
1 do. do. spoon,	" " 3
1 do. do. motto *Spero meliora*	" " 4
1 do. do. fork, do.	" " 5
1 do. dessert do.	" " 5
1 do. tablo spoon, do.	" " 5
1 do. tea do. do.	" " 5
1 do. table fork, with intitials "H.D.S.G."	
1 do. do. do. "A. McD."	
1 do. do. do. "G.A.M."	
1 do. do. do. "J.F."	
1 do. do. do. "J.F.B." or "J.S.B."	
1 small silver plate (engraved) "Sir John Franklin, K.C.B."	

A Star with motto, "Nec Aspera Terrent" on one side, and on the reverso "G. R. MDCCCXV."

Also, a number of other things of minor importance, as they have no particular marks by which they could be recognised, but which along with those above named, shall be handed over to the Secretary of the Hon. Hudson's Bay Company.

JOHN RAE, C. F.

Repulse Bay, July, 1854.

Commercial Enterprise and Scientific Investigation.

Professor Airy, the astronomer Royal, has recently published a letter in which the power and capabilities of private companies are strikingly contrasted with the efforts of government in scientific investigations and great commercial projects. Among other interesting illustrations he gives an account of former and recent attempts to determine the difference of longitude between the observatories of Paris and Greenwich. As the details have already been published there is no need to repeat them. It may be sufficient to observe that the determination of the difference of the longtitude between two places is a process which has, up to the present time, demanded the exercise of the most profound mathematical knowledge, great mechanical aptitude, and very extensive pecuniary resources. It was supposed to be matter more peculiarly the business of Governments than of private individuals, and Governments have undertaken it in full consciousness of their superior capabilities. The national authorities of England and France took the matter in hand in the year 1787, and endeavoured to attain their object by the expensive means of an accurate survey in both countries. The result of their labors so little satisfied scientific men that, in the words of Professor Airy, "it was thought desirable to take the earliest opportunity of verifying the result by an operation of a different kind."

In 1825, the Governments of the two nations again made an attempt in the same direction. Sir. John Herschel and Captain Sabine, assisted by other scientific persons, were appointed by the English Government; and a body of distinguished engineer officers undertook the duty in France. In spite of these apparently efficient preparations, the costly experiment failed. Other attempts have been made, but with similar results.

At length the submarine telegraph was established, and the astronomical authorities on both sides of the Channel applied to the company for assistance in establishing a connection by galvanic telegraph between the Observatories of Greenwich and Paris. The permission was granted, the company behaving in a most liberal manner. Several thousand observations were made, and the success has been complete. It may be sufficient to show the superiority of the method afforded by the use of the electric telegraph; Prof. Airy states that one single observation made by the telegraph gives a more accurate result than can be deduced from the whole mass of observations in the attempt made in 1825 to determine the difference of longitude by signals. "The former determination is now," says the Professor, "shown to be eroneous by almost a second of time (a large quantity in astronomy), and this correction is nearly certain to its hundredth part. For this gain of accuracy, this veritable advance of science, we are indebted in the first instance to the power of commercial association." Professor Airy may well congratulate the world on the growing tendency towards a closer union between commerce and science. Here is a most important scientific result achieved by the means of the resources of a company which never proposed to itself any such end. The Electric Telegraph Company was a purely commercial speculation. There was no intention certainly of employing it to determine the difference of longitude. Nevertheless, while carrying on international intercourse, it solves a philosphical problem which has baffled mighty states as a mere matter of by-law. It makes no display. It trumpets forth no grand preparations. The operations of the astronomers caused no interruption of its wonderful activity. It throws off the solution of a great astronomical difficulty, as carelessly as if nothing wonderful were to be achieved, and receives the thanks of the scientific men as a matter of course. If any one would wish to have a convincing proof that the future destinies of the world will depend, not on individual wills, but in the united agencies of the multitudes, he may have it, as the *Mining Journal* says, in Professor Airy's letter.

The Canadian Steam Navigation Company's New Iron Screw-Propeller Steam-Vessel "Canadian."

Built by Messrs. William Denny and Brothers, iron ship-builders, Dumbarton; machinery by Messrs. Tulloch and Denny, engineers, Dumbarton; 1854.

Dimensions.	Ft.	Tenths.
Length on Deck	277	2
Breadth at two-fifths of middle depth	35	0
Depth of hold amidships	80	0

Tonnage.	Tons.
Hull	1764 59-100
Engine-room and shaft space	719 40-100
Register	1045 19-100

Fitted with a pair of direct-acting engines of 300-horse (nominal) power; diameter of cylinders, 62 inches; length of stroke, 3 feet 6 inches. Screw-propeller, diameter, 16 feet; length on axis, 5 feet 8 inches; pitch, 25 feet; two blades. Two tubular boilers, fired at both ends, having two funnels. Length of boilers, 18 feet 10 inches; breadth, 9 feet 9 inches; depth, 14 feet 3 inches. Twelve furnaces, six in each boiler, three at each end; length, 6 feet 6 inches; breadth, 2 feet 7 inches; 732 tubes, or 366 in each boiler, or 183 at each end; diameter $3\frac{1}{4}$ inches; length, 6 feet 6 inches. Funnels, diameter, 4 ft. 10 inches, and 48 feet long; intended steam pressure, 14 lbs. Frames of hull, $6 \times 3 \times \frac{5}{8}$ and $\frac{1}{2}$ inches, spaced 12 inches apart; 19 strakes of plates, tapering from 1 to 7-16ths of an inch in thickness; eight bulkheads.

For the Liverpool, Quebec, and Montreal line.

DESCRIPTION.

A shield figure-head; no galleries; elliptical sterned and clinch-built vessel; three masts; barque rigged; standing bowsprit; three decks (flush); clipper-bow.—*Artisan.*

INCORPORATED BY ROYAL CHARTER.

The attention of members of the Institute is requested to the subjoined extracts from the Regulations and By-Laws:—

1. The sessions of the Institute shall commence annually on the first Saturday in December; and ordinary meetings shall be held on every succeeding Saturday (omitting the Christmas holidays), until the first Saturday in April; but it shall be in the power of the Council to protract the sessions if it should seem necessary. The chair may be taken when five members are present.

2. The chair shall be taken by the officer or member entitled to the same; and the business of the evening commence at eight o'clock precisely, and be conducted in the order prescribed in the by-laws.

3. Every member shall have the privilege of introducing two visitors to be present at the public business of the Institute by ticket of admission, on which the name and address of each visitor must be written.

4. The annual general meeting of the Institute shall be held on the third Saturday in December, at seven o'clock in the evening, to receive and deliberate on the report of the Council on the state of the Institute, and to elect the officers and members of the Council for the ensuing year.

5. The Council may, at any time, call a special general meeting of the Institute for a specific purpose, giving to city members six days' notice; and they are at all times bound to do so, on the written requisition of five members, which shall specify the nature of the business to be transacted.

6. Those members of the Institute residing at a distance from the city, shall have the power of forming themselves into Branch Societies, for the purpose of holding meetings, and discussing scientific and other subjects; and are to be governed by the regulations of the Institute, and such other By-laws hereafter to be enacted by them and approved by the Council.

BY-LAWS.

I. At the ordinary meetings of the Institute, every Saturday evening, the following order of business shall be attended to, as closely as circumstances will admit:—

1. The Minutes of the previous meeting to be read and confirmed, and signed by the Chairman; and no entry shall be considered valid until this be complete.
2. New members present to be introduced to the meeting.
3. Names of candidates for admission to be announced.
4. Business arising out of the Minutes to be entered on.
5. Communications received since the last meeting to be announced, and read if required.
6. Donations received and acknowledged.
7. Communications from the Council to be brought forward.
8. Candidates to be balloted for. A ballot shall be taken for the entire body of candidates proposed for admission; if one or more black balls appear, the ballot shall be taken for each individually, and any candidate shall be rejected against whom appear a number of black balls equal to one-fourth of the number of members voting.
9. Papers on the lists to be read.

II. Notices of questions to be brought forward for discussion, must be given at least one week before the same shall be brought forward; and it shall be competent for the Council, or for any member to propose a subject for discussion.

III. A circular letter may be sent to all the country members, at the commencement of each session, with a list of questions that are appointed for discussion at the ordinary meetings of the Institute, requesting communications from the members on them, or on any other subject connected with the objects of the Institute.

IV. A similar letter may also be transmitted about the middle of the session, with the addition of any new questions that may have been brought forward and accepted; and at the end of the session, a list of questions shall also be sent to all the members, in order to collect information during the recess. Each letter shall contain a list of the written communications that have been made to the Institute.

Notices of Books.

Geological Survey of Canada—Report of Progress for the year 1852-53. Printed by order of the Legislative Assembly.

The large amount of space occupied by the reports of the proceedings of the British Association for the Advancement of Science, prevents us from giving an abstract of Messrs. Logan, Murray, and Hunt's valuable reports on the Geological Survey of Canada for the year 1852-53. The December number of this Journal will contain copious extracts from these important documents.

The Principal Forms of the Skeleton and of the Teeth. By Professor R. Owen, F.R.S., &c. Philadelphia: Blanchard and Lea, 1854, oc, pp. 329.

The Principles of Animal and Vegetable Physiology; a Popular Treatise on the Functions and Phenomena of Organic Life. To which is prefixed a General View of the Great Departments of Human Knowledge. By J. Stevenson Bushnan, M.D. Philadelphia: Blanchard and Lea, 1854, oc, pp. 233,

For the reason given above, a detailed notice of these works is deferred until the next issue of this Journal.

Extraction of Metals by the Battery.—Bunsen has been investigating the circumstances most favorable to the separation of metals from their compounds. These are the density of the current, and the greater or less concentration of the liquid to be decomposed. The greatest effect is obtained with the most dense current and the most concentrated solutions. Density denotes the concentration of electric action upon a single point, analogous to the concentration of heat and light in the focus of a concave mirror. Thus, we connect a charcoal crucible with the positive pole of the battery, and place in it a small capsule of glazed porcelain containing the liquid to be decomposed. The space between the capsule and crucible is then filled with hydrochloric acid, and the liquid in the small capsule is put in communication with the battery by means of a thin platinum wire, which must be exactly in the centre. The current is then established between a large surface, the charcoal crucible, and a fine platinum wire in which it is concentrated, and the current becomes capable of overcoming affinities which have resisted powerful batteries. The whole apparatus is then set in a large porcelain crucible, and kept warm in the sand-bath. Chrome and manganese are thus readily separated from the solution of their chlorides, provided the negative pole is small and the solution very concentrated. In this state the chrome is quite pure; it presents the appearance of iron, but is less affected by moist air. Heated in the air, it is converted into sesqui-oxide. It resists nitric acid even when boiling, but is acted on by hydrochloric and dilute sulphuric acids, forming proto salts. Its density coincides with the density calculated from the atomic volume, Bunsen obtained sheets of chromium of more than 50 square millimetres surface; they were brittle, and showed a perfect polish on the side which had been in contact with the platinum. Manganese was obtained in the same manner in very little plates of more than 100 square millimetres surface, which oxidised in damp air almost as rapidly as potassium. To induce barium and calcium, a denser current was required. Concentrated solutions of the chlorides are acidulated with hydrochloric acid, and poured boiling into the glazed porcelain capsule. Amalgamated platinum wire in connection with the battery is then introduced, upon which calcium is deposited in a grey layer, easily detached, and containing a little mercury. If water or moist air be present, this amalgam is rapidly oxdised with evolution of hydrogen; when heated it burns with brilliancy. Barium is more easily extracted. The chloride is powdered and made into a paste with water acidulated with hydrochloric acid, heated to 200° Fah. in the water-bath, and the current established. The amalagam of barium thus obtained is silvery white, and very crystalline. In contact with moist air, it is converted into hydrate of baryta. If heated in a current of hydrogen upon a charcoal support, the mercury is carried off, and a residue of porous barium appears, containing brilliant metallic particles.

Consumption of Coal in the United States.—The Consumption of coal does not increase so rapidly as was supposed. In 1852 the increase was less than 13 per cent., and left a surplus in the market. In 1853 the increased supply was less than 9 per cent. from all sources. To this, of course, is to bo attributed the high price of coal during the latter part of the year; but taking the average over 12 per cent. it will reach it. We see no good reason to believe that this average per centage in the demand is likely to bo exceeded in the present year, which would require an increase in the supply of about 623,000 tons in 1854, from all sources, to keep the market healthy. The increased supply can easily bo furnished by the different regions, provided dealers and customers will come forward and take coal early in the spring. The following is a summary of operations in Schuylkill county:—

Total number of collieries...	113	Number of operators...........	82
Red ash collieries	58	Employed at collieries	9792
White ash collieries..........	55	Miner's houses out of towns	2756

Whole capital invested in these collieries	$3,462,000
By individual operators, about	2,600,000
Thickest vein worked at Heckscherville	80 ft.
Smallest	2 ft.

All the coal lands now worked in Schuylkill county are owned by six corporations, and about 60 individuals. About 25 of the owners reside in Schuylkill county, and the balance abroad. The coal rent will average 30 c. a ton. The product of 1853 in Schuylkill county was 2,551,603 tons. This would give an income of $765,480 to the landholders in the shape of rents for the year.—*Postville Mining Journal.*

On the Permanent Expansion of Cast Iron by successive Heatings.—In the Memoirs of the Industrial Society of Hanover for last year, there are some interesting remarks on this question. The remarkable phenomenon that cast-iron presents on being heated, of not returning back to its original volume, but of continually showing an increase of the volume, and of permanently acquiring an enlarged volume by successive heatings and coolings, had been first observed by Rinsep, in 1829. That chemist found that a cast-iron retort, whose capacity was exactly measured by the quantity of mercury which it could contain, held at first, 9·13 cubic inches; after the first heating and cooling, 9·64 inches; and after three heatings, up to the melting point of silver, 10·16 cubic inches, The cubical expansion ought, therefore, to be 11·28 per cent., which gives 3.76 per cent. nearly of linear expansion.

At subsequent periods different phenomena were observed, more or less confirmatory of this law. The cast-iron bars of grates, where powerful fires were made, were frequently observed to elongate, so as to become jammed tight in their frames; and when these obstructed all further enlargements, the bars become curved or twisted. Mr. Brix, in his work on the calorific power of the fuels of Prussia, has detailed a few experiments on this subject. By the aid of several measurements, he has shown that the entire permanent elongation increases after each successive heating, but that the amount produced by each heating diminishes the more frequently the bar is heated, until it finally becomes insensible. Thus, a furnace bar 3½ feet long, after being three days exposed to a moderate fire, had already acquired a permanent elongation of 3-16ths of an inch, or ·446 per cent.; at the end of seventeen days, 1·042 per cent.; and after thirty days, 2 per cent., but had not yet reached its maximum. Another bar of the same kind, after a long service, had a permanent elongation of 3 per cent.

If it be remembered that bars while exposed to the fire undergo another temporary elongation, we must agree with M. Brix, that an allowance should be made in a bar which has not as yet been used, amounting to 4 per cent. of its length, for this cause of elongation. The bars must, of course, be sufficiently long to stand between their supports when cool; but it seems that hitherto sufficient room has not been given for this permanent expansion in laying down new bars.

Robinson's Patent for the Novel Application of the Slags or Refuse Matters obtained during the Manufacture of Metals.—Dr. George Robinson, of Newcastle-on-Tyne, has taken out a patent for the formation of sheets or plates from the slags produced in the various processes of manufacturing and refining iron and other metals. He proposes to convert the molten slag into sheets by pouring it upon an iron or other table previously heated, and then rolling or pressing it to any requisite thickness, according to the purpose for which it is intended to be used. The plates thus formed are afterwards to be annealed, by being allowed to cool gradually in any suitable furnace. While in a plastic state, the sheets may be ornamented by means of suitable elevations and depressions on the rollers by which they are formed. When cold the thin sheets of slag may be used for roofing instead of slates, the thicker plates for flooring, and those having patterns on their surface for covering walls. The Newcastle papers, in alluding to the invention, state that in that district alone there are materials for a very extensive manufacture, and in the other great seats of metallurgic operations the supply of suitable slags is practically unlimited.

The Precious Metals in England.—At a time when the extraction of gold in England occupies so much attention, the following account of the presence of silver in England may prove interesting. An immense silver mine was worked in the vicinity of Aberystwith, in the reign of Elizabeth, by which a Company of Germans enriched themselves; after whom Sir Hugh Middleton accumulated £2,000 a month out of one silver mine at Bwlch-yr-Eskir, by which produce he was enabled to defray the expense of bringing the New River to London. After him, Mr. Bushell, a servant of Sir Francis Bacon, gained from the same mine such immense profits, as to be able to present Charles I., with a regiment of horse, and to provide clothes for his whole army. Besides this he advanced, as a loan to his Majesty, no less a sum than £40,000, equal to at least four times the amount of the present currency; and he also raised a regiment amongst his miners at his own charge.

Rosin Oil for lubricating Machinery.—Payen and Buran recommend the oil obtained by the distillation of common rosin with from 5 to 10 per cent of quicklime, as a good material for greasing machinery. As it is generally slightly acid, even when distilled with lime, it is recommended to add from 2 to 5 per cent. of lime or magnesia to the cold oil, which unites with the free acid, and gives the whole mass the consistence of butter.—*Polytechnisches Centralblatt, No. 12, 1853.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—September, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.
					°	°	°	°	°													
1	29·797	29·757	29.681	29·732	62·8	61·7	64·4	63·97	+ 0·93	0·503	0·490	0·546	0·526	·90	.91	·93	·91	N N E	S S E	N E	3·43	1·330
2	·671	·612	.587	.621	64·8	81·0	68·2	71·40	+ 8·67	·561	·756	·595	·641	94	64	89	84	Calm	Calm	Calm	1·37	0·595
3	·703	·709	—	—	70·2	85·3	—	—	—	·673	·756	—	—	94	64	—	—	NWbN	S S W	—	2·58	...
4	·717	·657	.647	.664	66·0	80·2	68·4	71·83	+ 9·70	·542	·718	·560	·611	87	71	84	80	NEbN	E S E	Calm	2 62	...
5	·605	·533	.530	.550	64·5	93·1	73·9	77·95	+16·12	·568	·743	·671	·676	96	49	82	75	Calm	S S W	Calm	1·47	0·020
6	·533	·463	.576	.525	71·1	89·0	71·2	77·63	+16·20	·660	·668	·658	·666	80	51	89	73	W S W	SWbW	W	5·38	0·250
7	·677	·690	.771	.714	56·9	77·4	53·1	63·48	+ 2·33	·410	·477	·350	·437	91	49	88	77	Calm	W b N	Calm	5·72	...
8	·716	·618	.512	.607	50·0	69·5	57·8	60·17	— 0·57	·328	·409	·431	·407	92	58	92	81	N b W	N	N b E	4·66	1·705
9	·471	·494	.529	.503	55·5	59·7	57·7	57·95	— 2·40	·395	·439	·406	·416	92	87	87	88	N N E	N N E	N b E	5·34	0·030
10	·582	·589	—		53·1	65·7	—	—	—	·263	·321	—	—	66	52	—	—	NEbN	N E	—	5·86	...
11	·677	·600	.504	.582	46·2	69·5	63·0	60·42	+ 0·77	.278	·420	·538	·415	90	60	96	81	N	E b S	S E b E	3·68	...
12	·451	·555	.713	.592	61·1	77·0	58·5	64·68	+ 5·45	·490	·586	·350	·441	93	65	73	74	Calm	NWbW	N N W	8·60	...
13	·877	·873	.800	.848	48·3	68·4	55·3	56·57	— 2·28	·251	·412	·347	·336	75	60	81	74	N N E	E	E	5·60	0·395
14	·698	·578	.612	.623	55·6	64·5	63·2	61·25	+ 2·92	·403	·534	·542	·493	93	90	96	93	N b E	N b E	Calm	1·53	0·140
15	·737	·813	.931	.836	59·2	62·2	45·4	54·93	— 2·98	·403	·290	·249	·312	82	53	83	74	N b W	N b W	Calm	7·24	...
16	·994	·961	30.001	.983	42·7	65·8	50·0	53·85	— 3·67	·235	·345	·260	·295	87	56	73	72	Calm	NWbN	N	3·02	...
17	30·086	·993	—	—	45·5	60·8	—	—	—	·227	·318	—	—	75	61	—	—	N N E	Calm	—	1·38	...
18	29·778	·618	29.539	.632	50·5	69·6	65·0	63·37	+ 6·75	.254	·561	·549	·485	70	80	92	83	Calm	S	SWbW	3·81	0·165
19	·445	·332	.323	.366	64·6	77·3	60·7	66·92	+10·80	·558	·468	·453	·488	94	51	87	78	SWbW	W	NWbN	10·89	0·245
20	·594	·734	.872	.751	50·6	55·5	42·4	48·52	— 7·08	·253	·217	·201	·219	69	50	75	66	NWbN	N b W	N N W	9·52	...
21	·950	·906	.940	.938	41·3	59·9	51·7	50·77	— 4·35	·214	·235	·355	·257	83	45	94	72	N b E	S b W	W	5·47	0·005
22	30·099	30·112	30.028	30.081	36·3	61·5	52·2	51·98	— 2·65	·183	·372	·320	·292	86	70	83	76	N W	S	S W	3·44	...
23	29·956	29·812	29.734	29.825	40·9	70·7	56·5	56·78	+ 2·57	·244	·427	·387	·357	97	59	86	79	Calm	S b W	Calm	4·03	...
24	·680	·581	—	—	52·8	71·6	—	—	—	·323	·485	—	—	82	65	—	—	W b N	S S E	—	1·73	0·080
25	·429	·438	.503	.464	57·6	70·2	61·4	63·55	+10·32	·417	·620	·470	·509	90	87	88	89	Calm	S b E	Calm	1·63	0·050
26	·596	·559	.553	.568	53·3	74·5	59·6	62·85	+10·12	·354	·613	·447	·484	88	74	89	86	Calm	S b E	Calm	1·39	...
27	·558	·459	.626	.547	59·3	79·0	57·6	65·08	+12·87	·448	·674	·444	·534	91	70	96	87	Calm	S W b S	NWbN	6·04	0·365
28	·693	·683	.727	.700	48·3	70·1	56·0	59·03	+ 7·20	·287	·324	·367	·346	86	46	84	73	NWbN	S b W	N b E	4·51	...
29	·966	30·047	30.092	30.048	48·1	60·6	42·2	50·70	— 0·62	·263	·309	·238	·272	80	60	90	76	N N E	E S E	N b E	4·40	...
30	30·098	29·973	29.781	29.923	41·6	60·9	52·0	51·47	+ 0·65	·202	·232	·351	.269	78	44	92	73	N N E	S E	Calm	2·86	Inap.
																		Miles.	Miles.	Miles.		
M	29·722	29·688	29.697	29·7008	53·73	70·34	57·98	61·04	+ 3·55	0·373	0·475	0·426	0·430	87	63	87	79	4·41	7·78	3·93	4·31	5·375

Highest Barometer...... 30·142, at 9·30 a.m. on 22d } Monthly range:
Lowest Barometer....... 29·302, at 4 p.m. on 19th } 0·840 inches.

Highest registered temperature 93°·6, at p.m. on 5th } Monthly range:
Lowest registered temperature 35°·8, at a.m. on 22d } 57°·8.

Mean Maximum Thermometer.............. 72°·59 } Mean daily range:
Mean Minimum Thermometer............... 49°·09 } 23°·50.

Greatest daily range.........35°·9, from p.m. of 6th to a.m. of 7th.

Warmest day....... 5th. Mean temperature...... 77°·95 } Differenee,
Coldest day......... 20th. Mean temperature...... 48°·52 } 29°·43.

Greatest intensity of Solar Radiation, 104°·8 on 6th, p.m. } Range,
Lowest point of Terrestrial Radiation, 29°·8 on 22d, a.m. } 75°·0.

Aurora observed on 6 nights: viz. 10th, 15th, 17th, 21st, 26th, & 27th·

Possible to see Aurora on 22 nights.

Impossible to see Aurora 8 nights.

Raining on 14 days. Raining 49·8 hours; depth, 5·375 inehes.
Thunder Storms oecurred on the 1st, 2d, 3d, 6th, 14th, and 27th.
Sheet Lightning, not accompanied by thunder or rain, observed on the 18th, and 19th.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1579·54	1051·45	632·80	657·49

Mean direetion of the Wind, N 18° W.
Mean veloeity of the Wind, 4·31 miles per hour.
Maximum velocity, 25·5 miles per hour, from 11·30 to 12·30 p. m. on 19th.
Most windy day, the 19th; mean velocity, 10·89 miles per hour.
Least windy day, the 2d; mean velocity, 1·37 " "
During the violent thunder storm on the 6th, the velocity of the wind from 4h. 00m. to 4. 25m. p.m., was at the rate of 32·4 miles per hour.

A beautiful, very perfeet, and well defined Auroral Arch or Band extending aeross the Zenith from West towards East, from 8·15 to 9·30 p.m., on the 26th.

Hoar Frost was observed on the mornings of the 21st, 22d, and 30th. That on the 21st was the earliest noticed at the Observatory this season.

The Registered Maximum on the 5th (93°·6) is the highest temperature yet recorded at this Observatory in September.

Comparative Table for September.

Year.	Temperature. Mean.	Dif. f'm Avr'ge.	Max. obs'vd.	Min. obs'vd.	Range.	Rain. D's.	Inch.	Wind. Mean Vel'y.	
	°	°	°	°	°				
1840...	54·0	—4·0	70·2	29·4	40·8	4	1·380	...	
1841...	61·3	+3·3	79·9	37·5	42·4	9	3·340	0·26	lb.
1842...	55·7	—2·3	83·5	28·3	55·2	12	6·160	0·45	lb.
1843...	59·1	+1·1	87·8	33·1	54·7	10	9·760	0·57	lb.
1844...	58·6	+0·6	81·5	29·6	51·9	4	Impt.	0·26	lb.
1845...	56·0	—2·0	78·8	35·3	43·5	16	6·245	0·34	lb.
1846...	63·6	+5·6	84·0	39·0	45·0	11	4·595	0·33	lb.
1847...	55·6	—2·4	74·8	38·1	36·7	15	6·665	0·33	lb.
1848...	54·2	—3·8	80·9	29·5	51·4	11	3·115	5·81	Miles.
1849...	58·2	+0·2	80·6	33·5	47·1	9	1·480	4·23	Miles.
1850...	56·5	—1 5	76·0	31·7	44·3	11	1·735	4·78	Miles.
1851...	60·0	+2·0	86·3	33·4	52·9	9	2·665	5·45	Miles.
1852...	57·5	—0·5	81·8	36·1	45·7	10	3·630	4·60	Miles.
1853...	58·8	+0·8	85·4	36·1	49·3	12	5·140	4·30	Miles.
1854...	61·0	+3·0	93·1	36·3	56·8	14	5·375	4·31	Miles.
								4.78	miles
M'n.	58·01		81·64	33·79	47·85	10.5	4·377	0.36	lb

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——September, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	30.167	30.124	30.057	50.0	65.8	59.7	·316	.449	.452	·84	·72	·89	E N E	N E b E	E b N	2.30	10.19	0.15	...	Cum. Str. 2.	Str. 10.	Cum. Str. 10.
2	29.971	29.927	29.887	63.0	64.1	63.1	516	565	567	89	96	98	N E b E	S S W	S S W	6.00	0.60	2.15	0.610	Rain.	Slight Rain.	Str. 10.
3	.880	.820	.961	66.0	83.0	66.0	615	600	516	96	54	80	W	N W b W	N	Inap.	3.84	6.25	...	Str. 10.	Clear.	Cir. 2. [L'ng.
4	30.017	30.010	.931	53.0	80.1	61.6	361	681	322	87	68	59	E b N	N E b E	N E b E	1.62	8.73	1.41	...	Cum. Str. 4.	Cir. Str. 4.	Str. 10, Th. &
5	29.933	29.842	.947	64.0	87.6	73.0	401	854	692	67	68	86	E b N	S W b S	N E	2.53	0.86	0.37	0.903	Str. 9.	Str. 2.	Do. 4, Dis. Th.
6	.804	.787	.765	65.6	91.0	70.0	615	739	692	96	53	95	E N E	W b S	W	0.64	0.87	7.50	1.036	Fog.	Clear. Dis. Th.	Do. 10.
7	.845	.962	30.053	65.3	70.4	52.4	497	597	283	80	82	70	N E b N	N E b N	N	6.31	10.50	2.96	...	Str. 4.	Cum. Str. 2.	Clear.
8	30.028	.984	29.898	47.0	60.0	54.4	291	441	400	86	84	93	N E b E	N E b E	N E	Calm	Inap.	Calm	0.200	Cir. Cum. Str. 8.	Rain.	Cum. Str. 10.
9	29.821	.797	.887	51.4	72.1	54.4	361	473	304	93	61	70	E N E	N b E	N N W	0.19	2.40	0.27	...	Cum. Str. 4.	Cir. 2.	Clear.
10	30.040	30.023	30.048	45.0	61.8	41.7	218	286	217	69	53	79	E N E	E N E	E N E	15.87	6.59	3.05	...	Clear.	Clear.	Do. Aur. Bor.
11	30.040	30.023	29.876	33.2	68.8	59.8	187	358	402	90	52	79	E N E	S W b S	S W b S	Calm	Inap.	0.25	...	Do.	Do.	Cum. Str. 4.
12	29.750	29.760	.968	56.2	76.7	57.1	432	597	281	94	67	69	S W b S	W b S	N	0.59	2.75	7.97	0.136	Str. 10.	Cum. Str. 4.	Clear, Aur. Bo.
13	30.286	30.261	30.262	46.2	67.2	44.2	303	328	241	93	49	79	E N E	N E b E	E N E	3.75	1.25	0.85	...	Clear.	Clear.	Do. do. do.
14	30.154	30.032	29.913	42.5	59.0	53.8	263	452	386	90	89	93	E N E	S S W	S	Calm	1.13	11.25	0.800	Do.	Rain at noon.	Rain.
15	29.926	29.999	30.105	55.5	63.4	48.0	394	326	242	88	56	69	N E b N	N W	N N W	Inap.	Calm	6.75	0.200	Cir. Str. 8.	Clear.	Clear, F't.Aur.
16	30.205	30.139	30.249	42.1	58.1	41.1	208	274	217	73	55	79	N W	N W	N W	1.25	11.90	13.34	...	Clear.	Cir. C. Str. 4.	Do. [Bor.
17	30.376	30.277	30.259	44.1	66.2	49.1	261	317	233	85	49	64	N W b W	W b N	W b N	3.00	3.73	3.19	...	Do.	Clear.	Do. Aur. Bor.
18	30.192	30.000	29.864	44.0	69.4	63.2	291	541	488	94	76	84	W b S	W b S	S W	Calm	Calm	1.76	...	Cir. Str. 9.	Cum. Str. 4.	Rain at 8.40.
19	29.636	29.624	.526	64.4	76.0	62.0	565	568	472	94	64	84	W	N W b W	W	Calm	11.75	5.28	0.330	Str. 10.	Do. 8.	Str. 2, Lig. R'n
20	.682	.942	30.098	47.7	64.2	39.2	313	425	196	93	71	76	N b W	N b W	N b W	11.30	12.17	9.78	1.453	Rain.	Do. 8.	C'r.A.B.[11.30
21	30;268	30.237	30.300	36.6	56.6	44.0	178	287	231	86	62	76	N b W	W N W	W	Calm	0.50	2.77	···	Clear.	Clear.	Do. do. do.
22	30.294	30.273	30.210	38.1	63.6	46.7	236	366	306	94	63	91	W N W	W N W	W	Calm	Calm	5.75	···	Do.	Cum. Str. 4.	Do.
23	30.277	30.144	30·030	41.0	71.0	60.6	253	481	383	92	64	71	W	W N W	W N W	2.04	11.12	10.01	···	Do.	Do. 2.	Cir. Str. 4.
24	29.951	29 881	29.869	56.8	76.2	56.3	408	541	385	89	61	84	W N W	W N W	S E	6.93	4.06	2.50	···	Cum. Cir. Str. 4	Clear.	Clear.
25	.742	.729	.834	48.0	64.7	62.0	334	565	528	96	94	94	S E b E	W b N	W b N	1.14	0.72	3.03	0.266	Fog, Rn'd 10.25.	Cum. Str. 8.	Cum. Str. 5.
26	.852	.842	.865	59.1	74,2	62.5	504	588	528	99	70	94	W	W	W	Calm	5.27	1.06	···	Cir. Str. 4.	Do. 2.	Clear, Aur.Bor
27	.825	.704	.765	58.6	82.2	66.8	500	628	605	98	58	94	W S W	W	N W	0.31	6.02	7.65	0.233	Clear.	Clear.	Str. 2, Th. Sh.
28	.952	.958	30.063	53.1	62.1	49.8	337	315	290	81	56	80	N	N	N N W	4.28	2.63	4.33	...	Do.	Do.	Cir.Str.4[6pm.
29	30.288	30.274	30.373	42.9	54.1	41.2	225	326	186	79	76	78	N E b N	N E b N	N E b E	3.75	1.12	3.75	...	Do.	Do.	Clear.
30	30.300	30.214	30.171	29.2	61.0	45.4	161	362	235	89	69	74	N b W	N b W	S W	0.44	Calm	0.34	...	Do.	Do.	Cir. Cum. 4.

Barometer	Highest, the 29th day	30·373
	Lowest, the 19th day	29·526
	Monthly Mean	30·001
	" Range	·847
Thermometer.	Highest, the 5th day	93°·4
	Lowest, the 30th day	29°·2
	Monthly Mean	58°·01
	" Range	64°·2
	Mean Humidity	·781
Greatest Intensity of the Sun's Rays		118°·9

Amount of Evaporation, 3·11 inches.
Rain fell on 11 days, amounting to 6·167 inches, and was accompanied by thunder and lightning on 4 days. Raining 15 hours, 16 minutes.
Most prevalent Wind, W. Least prevalent Wind, S.
Most Windy Day, the 20th day; mean miles per hour, 11·08.
Least Windy Day, the 8th day; mean miles per hour, Inap.
Aurora Borealis visible on 8 nights. Might have been seen on 10 nights.
First frost on the 11th day.
Snow fell at Quebec on the 22nd day.
Electrical Apparatus out of order.

The Canadian Journal.

TORONTO, DECEMBER, 1854.

Geological Survey of Canada.

REPORT OF PROGRESS FOR THE YEAR 1852-3.

The Report for the year 1852-3, recently printed by order of the Legislative Assembly, is one of the most voluminous of the series. It occupies one hundred and seventy nine octavo pages, and embodies a large amount of very valuable and instructive information respecting the Geology and Topography of Canada, as well as the distribution of economic materials in both Provinces. Mr. Logan's examination of the district which lies on the north side of the St. Lawrence, between Montreal and Cape Tourmente, below Quebec, appears to have been rendered very laborious on account of the want of a good map of the country. So inaccurate and deficient were the maps of the settled parts, that it became necessary to go over the whole ground on foot, and to measure, by pacing, the distances travelled. Mr. Logan pithily observes, that "the weariness resulting from the attention required to count one's paces accurately, every day, and all day long, for five or six months of assiduous exploration, *is best understood by those who have made the attempt.*"

"The country which lies between the upper end of the island of Montreal and Cape Tourmente on the left side of the St. Lawrence, and occupies the space intervening between the river and the flank of the metamorphic hills, to which Mr. Garneau, in his History of Canada, has given the name of the Laurentides, has a length of about 200 miles, and it gradually widens from a point at Cape Tourmente, to about thirty miles at Montreal, having thus an area of about 3000 square miles. It presents a general flat surface, rising in many places by abrupt steps, (the marks of ancient sea margins,) into successive terraces, some of which are from 200 to 300 feet above the level of the river, and the whole have a general parallelism with it. These terraces are occupied by clay and sand, and the latter predominating, gives them, as a whole, a light soil. In some parts extensive swamps prevail on the terraces, but there is not a lake in the whole area. The rivers which cross it, (some of them large streams, of which the St. Maurice is the greatest,) descending the flank of the metamorphic hills, all give a succession of falls and rapids before reaching the plain, affording a great variety of picturesque and beautiful cascades, and yielding a vast extent of water-power, capable of application to sawing timber and other manufacturing purposes.

Quitting the metamorphic rocks, these streams at once cut deep into the softer deposits of the plains, sometimes at a leap attaining nearly the level of the St. Lawrence, and intersect the country by numerous nearly parallel ravines; they generally display steep banks of clay and sand, but in a few instances run in troughs, exposing perpendicular sections of slightly inclined strata of limestone or black shale, piled upon one another to the height of from twenty to eighty feet.

The name which has been given in previous reports to the rocks underlying the fossiliferous formations in this part of Canada is the Metamorphic series, but inasmuch as this is applicable to any series of rocks in an altered condition, and might occasion confusion, it has been considered expedient to apply to them for the future, the more distinctive appellation of the Laurentian series, a name founded on that given by Mr. Garneau to the chain of hills which they compose.

The geological formations which underlie the district in ascending order would thus be as follows:—

1. Laurentian series.
2. Potsdam sandstone.
3. Calciferous sandrock.
4. Chazy limestone.
5. Birds-eye, Black-River, and Trenton limestones.
6. Utica slate.
7. Hudson-River group.
8. Oneida conglomerate.

Mr. Logan then proceeds to describe the distribution of these formations, together with the attitude they assume in the physical structure of the region. The occurrence of economic materials is next adverted to. No very promising field of enterprise appears to present itself in any part of the district examined.

"The materials having an economic value seem to be almost wholly confined to bog iron ore and iron ochres, together with stone fit for the purposes of construction and flagging, as well as limestone for burning, clays for common bricks and pottery, and peat, in some parts, fit for fuel." The observations of Mr. Logan respecting the distribution of auriferous drifts are highly important, as they settle, for the time, the question of the presence of workable gold fields in Canada.

"In the month of December, a few days were devoted to a farther examination of the distribution of this metal in the Eastern Townships, and particles of it were found in the valley of the St. Francis at various intervals from Richmond to Hunting's mills on the Salmon river, flowing into the Massawippi, a little above Lenoxville. Though the weather was rather adverse to the examination, on account of the cold and frost, yet the results were much the same as those of similar previous explorations farther to the east. One of the positions examined was on the road passing to the north of the mill-pond on the Magog river above Sherbrooke, where particles were met with in an ancient hard bound gravel, which probably has never been disturbed since the time when the surface arose from beneath a tertiary sea. The position is about 156 feet above the level of the St. Francis at Sherbrooke, and would probably be over 600 feet above the St. Lawrence in Lake St. Peter; this fact serves to shew that the metal is not confined to the lowest parts of the valleys, but will have a distribution co-extensive with the original drift of the district.

It may be considered that the auriferous drift has now been shown to exist over 10,000 square miles on the south side of the St. Lawrence, comprehending the prolongation of the Green Mountains into Canada, and the country on the south-east side of them. In following the range of this drift north-eastwardly, the researches of the survey have not extended beyond Etchemin Lake; but the general similarity of the rocks beyond, renders it probable that little change will be found for a distance extending much farther; perhaps to the extremity of Gaspé. It may be proper to remark that though the ascertained auriferous area is thus so much increased be-

yond the measure given to it in a previous Report, no fact has come to my knowledge of sufficient importance to authorize any change in the opinion that has already een expressed, *that the deposit will not in general remunerate unskilled labor, and that agriculturalists, artizans, and others engaged in the ordinary occupations of the country, would only lose their labor by turning gold hunters.*"

Mr. Murray's investigations were carried along the line between the neighbourhood of Kingston and Lake Simcoe. The general plan of operations embraced a set of north and south traverses between the shore of Lake Ontario and the rear of the surveyed lands, together with east and west offsets from the general course. The topographical information embodied in Mr. Murray's Report is highly interesting and valuable. The heights of the different Lakes, which appear to form a continuous chain along the line of operations, is given in detail. The following table contains the elevations of each Lake above the surface of Ontario :—

Name.	*Townships.*	*Height in ft.*	*Falls into*
Loughboro' Lake	Storrington and Loughboro'	166·12	Rideau River.
Sloat's Lake	Loughboro'	187·05	Lake Ontario.
Knowlton Lake	,, ...	217·53	Mud Lake.
Mud Lake	,, ...	217·53	Desert Lake.
Desert Lake	Bedford	217·53	Birch Lake.
Birch Lake	,, ...	217·53	Devil Lake.
Devil Lake	,, ...		Rideau River.
Canoe Lake	,, ...	229·97	Desert Lake.
Batting's Mill Pond	,, ...	287·00	Wolf L. & Rideau R.
Green Bay & Bob's L. ...	,, ...	384·80	Tay & Rideau Rivers.
Crow Lake	,, ...	398·88	Mud Lake.
Sharbord Lake	Oso and Olden	505·29	Madawaska & Ottawa Rs
White Lake	Olden	555·29	Sharbord Lake.
Cross Lake	Kenebec	412·84	Long Lake.
Long Lake	Sheffield	365·69	Beaver Lake.
Beaver Lake	Sheffield	307.22	Salmon R. & B. of Quinte
Balsam Lake	Bexley & Fenelon	588	Cameron's Lake.
Cameron's Lake	Fenelon	583	Sturgeon Lake.
Sturgeon Lake	Fenelon & Verulam	561	Pigeon Lake.
Pigeon Lake	Harvey	556	Deer Bay.
Buckhorn Lake	Ennismore, Smith, & Harvey	556	Deer Bay.
Chemong or Mud Lake..	Ennismore & Smith	556	Buckhorn Lake.
Deer Bay	Smith	553	Salmon Trout or Clear L.
Stony or Salmon Trout Ls	Dummer & Burleigh	526	Otonabee R. & Rice L.
Rice Lake	Monaghan, Alnwick, Hamilton, Otonabee	364	Trent R. Ontario L.

DISTRIBUTION OF THE FORMATIONS.

" The rocks of the area whose principal geographical features are given in the sketch, belong to two distinctly different periods; one set being fossiliferous and nearly undisturbed, and the other unfossiliferous and greatly disturbed, contorted and altered. The fossils of the former are all of the Lower Silurian age, and the strata to which they belong, as may be inferred, rest unconformably on the tilted edges of the latter. By drawing a straight line from about the middle part of Loughborough Lake, across the heads of Knowlton and Beaver Lakes, to Round Lake in Belmont, a small sheet of water a little beyond Belmont Lake, and then another from Round Lake to the northern extremity of Balsam Lake, a tolerably fair representation of the junction of the two series of rocks will be indicated; the metamorphic, to which you have given the name of the Laurentian series, keeping on the north, and the fossiliferous on the south side of the lines. There will, however, be several deviations from the regularity of the straight lines, occasioned by undulations in the more ancient rocks, bringing them occasionally to the surface on the south, while a number of outlying patches of the more recent formations are spread over portions of the country to the north."

The Laurentian series are described in the Report for 1845-6 on the Ottawa region, and the description there given applies equally to the rocks of the same series which came under Mr. Murray's notice in the Survey of 1852-3.

The kind and quality of economic materials met with in this survey are of considerable importance.

" The deposits of iron ore in Madoc, Marmora, and Belmont some of which have long been known and have been worked, will probably hereafter become of great commercial importance. The ore which was formerly smelted at the village of Madoc, by Messrs. Seymour & Co., and produced an excellent quality of iron, was mined on the eleventh lot of the fifth concession of the township. The bed appears to run through a black soft micaceous rock, and holds a course which as far as it was traced, was about W. by N., and E. by S., while the slope of the bed which is towards the south, was between seventy-five and eighty degrees. The greatest observed breadth of the bed appeared to be about thirty feet, and its average would probably not fall short of about twenty feet. A material similar to the soft black micaceous rock which accompanies the bed of ore on each side, appears every now and then to cut it diagonally in thin belts. In one place the bed is said to have been thus cut at distances of from every three to ten feet, and in another there was an unbroken part with a length of fifty feet. The ore is very black and very fine grained, and while the whole body of it is magnetic, some portions of it have polarity, one end of a fragment repelling and the other attracting the north end of the magnet. When the ore is bruised with a hammer on these portions of the bed, or on fragments taken from them, the particles adhere to one another and stand up on the mass as they would on a magnet, the ore being in short a natural magnet or loadstone. The portions which have polarity appear to run across the ore bed at right angles. Nodules of actynolite or green fibrous pyroxene, made up of radiating crystals, are disseminated in the ore, and yellow uranite is found investing small cracks."

Mr. Murray relates some curious instances of the popular *furor* in the search for precious metals which appears to have unsettled the minds of the inhabitants of our back woods.

" In almost all parts visited this year, but more especially in the back settlements, a great number of the inhabitants are possessed with the delusive belief, that the precious metals abound among the rocky ridges of the Laurentian country, and that they by their own individual exertions, are capable of realizing vast wealth. Iron pyrites, mica, plumbago, specular iron, galena, and other bright or metallic substances are indiscriminately collected, barelled and buried in the woods, with the full impression by those engaged in such business, that they have stored away so much gold and silver; and although every second person met with, had a specimen of some sort to present, with anxious enquiries as to its nature, hardly a single individual could be found who was willing to give the smallest information as to its locality. It was in vain to argue with such persons that the consequences of a proper examination, might possibly be more advantageous to the common interest than anything they were likely to accomplish in secret and unassisted; such an argument was only regarded as the result of a governmental scheme to deprive them of their imagined wealth; and an appearance of anxiety to procure any information only rendered their secrecy the more profound."

Mr. Hunt's Report embraces a valuable classification of the

Mineral Springs of Canada; the discovery of the presence of boracic acid in several springs, and the analysis and description of some new minerals. We proceed to extract the most prominent illustrations of these additions to our knowledge of the physical history of the United Provinces.

"Having in the month of October last, collected a farther supply of the alkaline water from the Grand Coteau at Chambly, described with an incomplete analysis, in my Report for last year, I was enabled to confirm the results before obtained, and to make a more extended examination. It will be recollected that it was described as a strongly alkaline water, containing beside chlorid of sodium, with traces of the iodid and bromid, and carbonates of lime and magnesia, a large proportion of carbonate of soda, besides silica in some soluble state. To these must be added, carbonates of baryta and strontia, and borate of soda. It is but a few months since Professor H. Rose, of Berlin, pointed out a reaction which enables us to detect borates, even when present in minute quantity. It depends upon the power of free boracic acid to change to red, the yellow colour of paper stained with turmeric. The liquid suspected to contain a borate is neutralized with hydrochloric acid, and slips of turmeric paper are dipped in it and allowed to dry, when they are to be moistened with somewhat diluted hydrochloric acid, which at once produces a red-brown colour when boracic acid is present. By the aid of this test, Fresenius, Bouis, and Filhol, have just succeeded in discovering the presence of boracic acid in many of the mineral springs of Germany and France, and the same means have enabled me to detect it in several springs in this Province. When the Chambly water is evaporated to one-tenth, and neutralized with hydrochloric acid, turmeric paper which has been three or four times dipped in it and dried, becomes very red when moistened with diluted hydrochloric acid. Our present processes do not afford us any direct means of determining the amount of boracic acid when associated with carbonates and chlorids; but some experiments to be mentioned farther on, serve to give an approximate notion of the proportion in which it exists."

CANADIAN MINERAL WATERS.

The number of mineral waters described in this and the preceding Reports is in all fifty-four. Of these twenty-two making the water bitter and disagreeable to the taste like sea-water, but far more intense; those chlorids are also present in large proportion in the waters of Kingston, Bay St. Paul, and Riviére-Ouelle, and render them unpalatable. The waters from 3 to 12, that of Riviére-Ouelle excepted, are very much alike in character, and are all agreeably saline to the taste. Of the waters among these last, which have been quantitatively, analyzed, the Intermittent of Caledonia will be seen to contain the largest amount of these earthy chlorids, after which follow the St. Léon, and Georgian Springs, then those of Lanoraie, Caxton and Plantaganet, which contain the least of all.

In the second division of saline springs, these earthy chlorids are wanting, and we find instead, a portion of carbonate of soda, which gives to the waters when concentrated, an alkaline or soapy taste. Some of these are at the same time strongly saline, but in others the alkali predominates, and renders the taste of salt in the evaporated waters, hardly perceptible. They all afford the reactions of bromine and iodine, and many, perhaps all of them, contain a portion of borate of soda.—Carbonates of baryta and strontia are found in all those which do not contain a portion of alkaline sulphate.

CLASS 1. SALINE WATERS.

Division B. Containing Carbonate of Soda.

	NAMES AND LOCALITIES.		IN 1000 PARTS.	SEE REPORT FOR
1	Varennes, (Outer Spring.) . . .	B	10·72	*1849 p. 49
2	" (Inner Spring.) . . .	B	9·58	* " " 51
3	Fitzroy, (Gillan's Spring.) . . .	B	8·34	*1851 " 49
4	Caledonia, ("Gas" Spring.) . . .	S	7·77	*1848 " 141
5	" ("Saline" Spring.) . .	S	7·34	* " " 143
6	Belœil.	B	7·33	*1851 " 51
7	La-Baie, (Courchêne's Spring.) . .	B	7·29	*1853 " 161
8	Chambly, (Rang-des-Quarante.) . .	B	5·74	1852 " 116
9	Ste-Hyacinthe, (Providence Spring.)	B	5·16	1850 " 102
10	La-Baie (Houlè's Spring.)	B	4.96	1853 " 161
11	Caledonia, (Sulphur Spring.) . . .	S	4.94	*1848 " 145
12	Chambly, (Grand-Coteau.) . . .	B	2.13	*1853 " 154
13	Ste-Martine.	S	1·98	1852 " 114
14	Nicolet, (Hèbert's Spring.) . . .	S	1·56	*1853 " 162
15	St.-Ours.	S	·53	* " " 157
16	Ste-Anne-de-la-Pocatière, ...	S	·36	1852 " 113
17	Jacques-Cartier River, ...	S	·34	*1853 " 159
18	Nicolet, (Roy's Spring), ...	S	. . . .	" " 162

The quantity of alkaline carbonate bears no constant proportion to the whole amount of saline matter, for while the waters of Varennes, Caledonia, Fitzroy and Belœil, contain but from ·05 to ·58 parts in 1000 parts of carbonate of soda, equal to from 1 to 12 per cent. of the whole amount of soda salts present, the Jacques-Cartier Spring contains 1·95, that of St--Ours ·134, that of the Grand-Coteau of Chambly 1·06, and Hébert's Spring in Nicolet, 1·13 parts, equalling 82, 63, 52, and 72 per cent. of the whole amount of alkaline salts present. These less saline waters then contain not only relatively, but actually, more alkaline carbonate than the more strongly saline springs. It will be understood that a small undetermined portion of the soda represented as carbonate, exists combined with boracic acid.

The second class of springs consists of a small number containing free sulphuric acid, together with sulphates of lime, magnesia, alumina, protoxyd of iron, and small portions of alkalies, without any trace of chlorine; they all contain sulphuretted hydrogen. Of these four are known, all being in the same region of Western Canada; they are the Tuscarora Sour Spring, containing 1·87 parts of sulphates and 4·29 of free hydrated sulphuric acid, in 1000 (See Report for 1848 p. 152); another in Niagara with about ·6 parts of sulphates of the above bases, and two parts of free acid in 1000; besides a third from near Chippawa, described by Dr. Mack, of St. Catharines, C. W., in the British American Journal, vol. v. p. 63, which in composition and strength is very much like that of Tuscarora, and a fourth furnished me by Dr. Chase of St. Catherines, from the vicinity of St Davids, and similar to the last, although weaker. (Report for 1850, p. 100.) The connection of these springs with the gypsiferous rocks, and their supposed relations to the deposits of gypsum, have been discussed in the Report for 1848.

The Charlotteville Spring is not included in either of the above classes, as its saline ingredients are principally earthy sulphates and carbonates, with but a very small proportion of chlorids; its solid ingredients amount to 2·49 parts in 1000. This water is remarkable for the great quantity of sulphuretted hydrogen gas which it holds in solution, amounting to 32·1 cubic inches to an imperial gallon. (Report for 1848, p. 157.)

The quantity given in that report, 26·8 cubic inches was calculated for an American standard gallon of 231 cubic inches. The feebly saline and sulphurous waters, 23, 24, and 25, of division A, resemble this in the predominance of sulphates.

All of the springs of division A, with the exception of those of Ancaster, which belong to the Niagara group, issue from Lower Silurian rocks; the water of Ste.-Anne, No. 17, comes from the Oneida conglomerate, and of the others, Nos. 3, 8, 16, 18, 21, and perhaps 6 and 14, issue from the Utica slates or the Hudson River group, while the others belong to the Trenton limestone, and that of Fitzroy to the Chazy or Calciferous sandrock, to the latter of which the water of Ste.-Martine is probably to be referred. Of the remaining thirteen, Nos. 1, 2, and 17 rise from the Utica slates, and the others from the Hudson River group, with the exception of 16, which issues from the conglomerates immediately above.

CLASS I. SALINE WATERS.—*Division A. Containing Chlorids of Earthy Bases.*

	LOCALITIES AND NAMES.		IN 1000 PARTS	SEE REPORT FOR
1	Ancaster (Salt Well)	S	36·57	*1848 p. 161
2	Bay St. Paul	..	20·68	1851 ,, 53
3	La-Baie-du-Fêbvre (Lafort's Spring) ..	B	15·94	1853 ,, 160
4	Alfred	B	14·50	1852 ,, 112
5	Caledonian ("Intermittent")	...	14·63	*1848 ,, 149
6	St.-Léon	B	13·83	*1849 ,, 53
7	Caxton	...	13·65	* .. ,, 55
8	Rivière-Ouelle	S	13·66	1852 ,, 113
9	Plantagenet (La Rocque's Spring)	...	13·16	*1849 ,, 57
10	Lanoraie	B	12·88	*1851 ,, 48
11	Gloucester	B	11·20	1852 ,, 112
12	Plantagenet (Georgian Spring)............	S	10·98	*1851 ,, 47
13	Kingston	S	10·16	1852 ,, 117
14	Point-du-Jour	B	7·36	1850 ,, 103
15	L'Original (Langlois' Spring)	...	6·40	1851 ,, 53
16	La-Baie-du-Fêbvre (Loizeau's Spring) .	B	5·44	1853 ,, 160
17	Ste.-Anne-de-la-Pocatière	S	5·06	1852 ,, 114
18	Pike River (Saline)	B	4·76	1849 ,, 59
19	Ancaster (Sulphur)	S	......	1848 ,, 162
20	St. Benoit	S	......	1849 ,, 60
21	Pike River (Sulphur)........................	S	......	1849 ,, 59
22	St. Eustache	S	1·88	1850 ,, 103
23	Les-Eboulmens (Sulphur)....................	S	·70	1851 ,, 53
24	Fitzroy (Grant's Sulphur Spring)	S	......	1847 ,, 124
25	Pakenham Village (Sulphur Spring) ...	S	......	,, ,, ,,
26	Westmeath (Petrifying Spring)	S	......	,, ,, ,,
27	Matan River Gaspé	S	......	,, ,, ,,

NEW MINERAL.—WILSONITE.

A specimen said to be from the second lot of the ninth concession of Bathurst, furnished by Dr. Wilson of Perth, to Professor Williamson of Kingston, to whose kindness I am indebted for the opportunity of examining it, has afforded me two very interesting species. It consists of a white crystalline pyroxene, or diopside, with copper pyrites, small crystals of silvery-gray mica, prisms of bluish-green apatite, and portions of a milk-white cleavable calcite, together with a rose-red mineral, having in its general aspect some resemblance to a common variety of wollastonite or tabular spar.

It occurs massive, with cleavages which indicate an oblique system of crystallization; according to Prof. E. C. Chapman, of the University of Toronto, who has examined a specimen in the collection of the Canadian Institute, the cleavage prism is apparently right rhomboidal, and the inclination of M : T= 110o—115o. The cleavages with M. and P are perfect and easily obtained, giving to the mass a fibrous aspect; with T the cleavage is imperfect. Hardness, 3·5; density 2·765—2·776. Lustre vitreous, shining, occasionally pearly on the cleavage surfaces. Color, rose-red to peach-blossom-red; sub translucent; fracture uneven.

ANALYSIS.

	I		II		III
Silica........................	42·90	...	43·00	...	43·55
Alumina .... }	28·10	...	27·80	...	27·94
Oxyds of Iron and Manganese } ...		...	·70	...	·20
Lime	6·94	...	6·72	...	6·50
Magnesia	3.99	...	3·83	...	3·81
Potash	8·27	...	8·27	...	8·37
Soda	·95	...	·95	...	1·45
Water	9 60	...	9·40	...	8·61
	100·15		100·67		100·43

As this interesting mineral appears to constitute a new species, I have named it *Wilsonite*, after its discoverer Dr. Wilson, who has long been known as a zealous student of the mineralogy of his district. It is to be wished that farther examination may detect distinct crystals of the mineral; a single imperfect one, having its angles rounded, was found in the calcite.

Lievrite.—A mineral which is to be referred to this rare species was received from C. Billings, Esq., of Bytown, a gentleman whose zeal and activity in the pursuit of mineralogy and geology give promise of valuable results. It was found as a rolled mass of some ounces in weight, coated with a hydrated oxyd like limonite, resulting from a superficial decomposition. Within, the mineral is unaltered, and has a hardness of 5·5, and a density of 4·15—4·16. Lustre sub-metallic, shining, occasionally iridescent; color velvet-black: streak and powder yellowish ash-grey; it is slightly translucent on the edges, very thin scales transmit a brownish light. Fracture uneven, brittle, strongly attracted by the magnet. It cleaves imperfectly in two directions oblique to each other.

Before the blow-pipe on charcoal the mineral intumesces and yields a black slag which is still magnetic. It gelatinizes readily with hydrochloric acid, but the silica which separates retains a small portion of iron. The solution contains protoxyd with some peroxyd of iron, besides a little magnesia, lime, and a trace of manganese. For its complete analysis the mineral was decomposed by fusion with carbonate of soda.

The amount of peroxyd of iron was determined by decomposing the finely powdered mineral with hydrochloric acid in a vessel filled with carbonic acid gas, and after adding recently boiled water, digesting it with a weighed plate of metallic copper, in the manner prescribed by Fuchs; the amount of copper dissolved, corresponded to 9·93 per cent. of peroxyd. Another determination was made with similar precautions, by adding to the diluted hydrochloric solution, phosphate of soda, and then acetate of soda in excess. The precipitated perphosphate of iron gave 10·80 per cent. of peroxyd, while the entire amount of iron as peroxyd was 73·6 per cent., giving 56·52 for the amount of protoxyd in the silicate. The results of analysis were as follows:—

Silica	27·80	...	28·20
Protoxyd of Iron	56·52		
Peroxyd ,, ...	10 80	...	9 93
Magnesia	2·59		
Lime	.64		
Loss by i nition	1·20		
	99·55		

The ratio between the oxygen of the silica and that of the other constituents, the water included, is 14·72 : 18·21, or very nearly 4 : 5, which is that required by Rammelsberg's

formula for lievrite. In the present specimen, the lime ordinarily present, is replaced by protoxyd of iron and magnesia.

On the Warming and Ventilating of Schools.

By Neil Arnott, M.D., F.R.S.

The lecturer began by remarking that it would be difficult to overrate the importance to this and all countries which have a cold winter season, of the arts of warming and ventilating, but that as yet, although scientific men judge correctly in regard to them, the mass of the people nowhere suspect the true magnitude of the evils springing from the existing defects. The public may be shocked occasionally by hearing of multitudes perishing from jail or ship fevers, or cholera, generated in confined air, and been in crowded and ill-ventilated churches, concert rooms, theatres, &c., but the more permanent injury to health, the early mortality and the diminished enjoyment of life suffered by large classes who occupy ill-ventilated dwellings, manufactories, or schoolrooms, escape common notice. A century ago men did not suspect the possibility of there ever being on earth such steam-engines as we now possess, or railways, steam-ships, gas-lights, penny postage, &c., all of which are the recent fruits of human ingenuity, and chiefly of the ingenuity of men in this country; but now, when all have perceived the extraordinary benefits obtained, and the evils avoided by these novelties, they would deem the world much less worth living in if such things did not exist; so the time is probably not far distant when in public estimation the sanitary arts of which we are to speak to-day will be regarded as things of high value.

The lecturer then observed that nature warms by the sun, and is always ventilating, that is to say, removing from about persons the air rendered poisonous by their breathing, or otherwise, through the agency of wind, and of the warmth given to the breathed air; this warmth, by causing dilatation of that air, or greater lightness under the same bulk, produces a movement upwards, and of the foul warm air departure, urged by the pressure of the surrounding heavier pure air taking its place.

Art imitates nature closely. It warms by fire, and it ventilates by using partly the natural agencies of the wind and the lightness of warmed breath, but also by using the strong upward movement in chimney flues of the hot air which has fed combustion below, and is called smoke. This air, by being made to fill the chimney flue as a light column, is pressed up by the surrounding heavier atmosphere with force proportioned to the difference of specific gravity and the height of the chimney. A heated chimney with an open fire-place is, therefore, constantly changing the air in the bottom of the room.

The lecturer then referred to the new arrangement of the open fire-place described in a paper read by him two months ago in the hall of the Society of Arts, and which was favorably received by the scientific men then assembled. He briefly recapitulated and explained, by diagram, the chief peculiarities of that fire-place—1st, Its being smokeless; 2d, Its saving much fuel; 3d, Its having much stronger ventilating force than other open fires; and 4th, Its taking away the foul air collected near the ceiling of the room instead of the purer air from below. He gave his opinion that this fire-place having the dimensions of its parts and adjuncts adjusted to the purpose in view, will be found to be the best simple means of warming and ventilating schoolrooms.

The modifications required for a school are—

1. The chimney ventilating valve to be larger.

2. The chimney-flue also from above the valve to be larger than below.

3. The chimney top to be surmounted by a moving cowl, or one of the fixed wind-guards, of kindred nature, which, when the wind blows, produce a degree of pumping action.

4. The large quantity of fresh air required for a schoolroom, to be caused to enter in a distributed manner, or at various inlets besides the principal one near the fire—as from the ceiling—or in summer by the tops of the windows opened a little on the side towards the wind, or by openings near the floor; all considerable openings on the leeward side being closed.

He remarked with respect to larger schools that—

1. It may be necessary in winter to warm the air which enters at a distance from the fire, by letting it touch the surface of tubes or flat vessels of metal, filled with water, circulating from a boiler at the fire.

2. It may be expedient to use, "at certain times of no wind and medium temperatures," the cheap ventilating pump, with light curtain valves, which has been adopted advantageously in passenger and convict ships. This pump injects or extracts any desired quantity of air with mechanical certainty, and is worked as easily as the bellows of a church organ.

3. It may be desirable to economise fuel by using the more complex pumping apparatus (already proved but not yet publicly exhibited), which causes the vitiated hot air in passing away from any crowd to give up its warmth to the pure air entering.

He then spoke of some other means of ventilating which are useful for particular cases, and under certain circumstances; but which, by unskilful persons, are often deemed universally applicable, and are so often employed amiss—

1. *Open Windows.*—Often allowable in summer—in winter dangerous if more than a chink at the top be opened. A thin sheet of cold air entering the room aloft, will, in descending, so mingle with the hot air of the room as not to be felt by persons below.

2. *Perforated or opening window panes, or openings in the wall.*—The same remarks apply to these as to the window opened. Such openings produce strong cold currents, where there is an open fire, and foul air does not pass out by them.

3. *The windsail of ships.*—A capacious tube of canvas suspended from the rigging, and leading to the spaces between the decks; the mouth, expanded by a hoop, or otherwise, is kept turned to the wind. This acts powerfully in strong winds, but in calms not at all.

4. A wooden or metallic tube or shaft leading from the open air into a room, and surmounted by a moveable cowl or hood, of which the mouth always turns to the wind by the action of the wind itself.—This may be regarded as a self-adjusting windsail of inflexible material.

5. Two such tubes opening into the same room or cabin—the mouth of one of the cowls being always towards the wind, to receive fresh air; the mouth of the other being turned away from the wind to let used air escape. The two together act with double force.

6. Mines are commonly ventilated by two shafts, one having a fire at the bottom, to render it the ascending air shaft; the other, without fire, lets fresh air descend. If there were no fire, the ventilating action would be in many cases so imperfect, that workers would not be safe below.

7. In some cases a single large shaft is made to answer the

purposes of two smaller. It is divided into two channels by a partition, called a brattice, made of iron plate or other fit material, and running down from the top to the bottom. One of the channels serves as the smoke-flue. This arrangement is objectionable on several accounts.

8. In imitation of this, a single short tube of metal, divided by a brattice or partition of metal into two channels, has been fixed through the ceiling of rooms, stables, &c., to ventilate them. It is much better than an open pane in the window, or a hole in the wall—and either of these is much better than no ventilation at all; but it has many faults. It has no source of heat immediately in one channel, like the mine-shaft, to make it draw strongly. The most impure air approaching the opening to pass out is always rubbing against, and mingling in a degree with the new air passing in. It injects and extracts much less strongly than the twin tubes described above, at No. 5. When there is little wind, and little difference of temperature in the two channels, there is little or no action. With closed doors and windows in the rooms below, and a strong fire, both channels become inlets of cold air. The cold air entering by it is not diffused in the room, and may prove hurtful, like that from an open window. Yet, with all these defects, it will, in certain cases, prove a useful aid, because it is a high opening to the external air, and has tranquil action. The model containing one or more burning candles, to represent men, which has been used to illustrate its action, is calculated to give to ordinary observers a very fallacious notion of its nature and power.

Anthracite Coal in the United States.

There are few subjects in the history of mining operations more remarkable than that of the anthracite coal field of Pennsylvania. For a century and a half after our countryman, William Penn, had founded that colony, and established that commonwealth, wood was the only fuel known to its population; but in time increased cultivation cleared away the forests, and Providence directed attention to the vast beds of coal to be found in the mountain ranges of the Schuylkill. The old German residents long laughed at the idea of making fires with what they called "black stones," and the adaptation of anthracite to the purposes of domestic fuel was generally ridiculed. The same silly prejudices still prevail in Ireland, where the anthracite abounds, and the inhabitants unaccountably prefer to expend the resources of their country in importing an inferior fuel to employing their own. Perseverance and science in the United States, however, overcame every difficulty, and by the use and constructien of improved stoves, on new principles of strong draught and ventilation, anthracite coal is now burnt in the American cities with as much facility as bituminous coal is with us, while its radiation of heat and consequent power of imparting warmth are far more intense.

The anthracite coal trade of Pennsylvania is of recent creation, while its rapid and progressive advance in that state alone is a source of wonder. It commenced in 1820, in which year the quantity of Pennsylvanian anthracite sent to market was 365 tons. In 1830, ten years after, it reached 174,734 tons. In 1840, another interval of ten years having elapsed, it reached 865,414 tons, and in 1853 it swelled to the prodigious amount of 5,195,151 tons. The value of this mineral fossil fuel is every day winning its way with the people, who are adapting it to their wants and their comforts, so that the demand is daily increasing with more than progressive rapidity. For the express purposes of furnishing supplies to meet the demand, railways have been laid down, others are in course of formation, and still more have been projected. We are beginning to follow the example of the Americans in using anthracite coal in our steam-ships—for instance, in the *Great Britain*, for her voyages to Australia; and it is not impossible that before long their methods and appliances for using it will be adopted for domestic purposes in many districts.

We are enabled to present to our readers a very interesting detail of a recent visit to the coal field of Pennsylvania. The coal bed lies in a range of the Blue Mountains, and is found on the north side, extending from east to west about 70 miles, varying in width from 6 to 12 miles, while on the south side there is nothing seen but mould and red shale rock. When digging in the very centre of the summit, a black line was discovered, running along the range east and west, which is, in fact, a line drawn by nature, dividing the coal from the stony rock. The face of the country, with the exception that the hills are higher, resembles the coal and iron region of the Forest of Dean, in Gloucestershire; the coal dips in various angles from the horizon, and in no instance horizontally, as in some coal fields in England. The seams and veins the best of which are about 60 feet wide and 12 feet thick, converge towards a common mass at the eastern end of the range, near a portion of the mountain called Maunch Chunk. Here, except the outside covering of rock and earth, the masses of the hills are solid coal, so much so, that a slice of the hill is cut away, exposing the coal, where is is actually quarried like stone, instead of being reached by subterraneous galleries and shafts, as at Pottsville. Many of the shafts in the latter district are 1000 feet deep, while a few are horizontal tunnels running into the mountains, while in some of the colleries there are horizontal tunnels, and then deep and perpendicular shafts crossing them. The mines are valuable in proportion as the coal is above or below the water-level of the springs.

The vast expanse of the galleries and shafts, of course, requires large quantities of timber for shores and props, and all the large timber in the vicinity of the collieries has been long exhausted. Although the neighbouring mountains would appear to be covered with trees, they are as yet too young and too small to be of much use, and timber for the use of the mines—and a few large ones will require a forest—has to be hauled for 15 or 20 miles, the expense of which exceeds that of the trees. The water raised from those mines is impregnated with iron and sulphur, and one feature in these valleys strikes the stranger with surprise—that is, that millions upon millions of tons of coal dust, or as it would be called in England small coal, are collected in heaps, apparently valueless. Hitherto these vast mounds of refuse, being anthracite, have been almost useless; had they been bituminous they would have been mixed, and converted into some kind of fuel; but we are told that as yet in America, means have not been adopted to render the small anthracite available for that purpose. Both in Wales and in Ireland it has long been the practice to mix the small anthracite with clay, which mass is then rolled into fire-balls, and used by the farming classes as fuel. Large quantities of it are also employed in the burning of lime for agricultural purposes, uses to which it will probably be hereafter extensively applied as cultivation spreads in America. Most of the collieries of Pennsylvania are worked upon royalties—that is, a coal company pays the owner of the land and mine at the rate of from 25 cents to 40 cents per ton for all raised, the company paying all the mining expenses, the land-

lord keeping a clerk to check the produce, which is also tested by the receipts from the mines at the railways and canals.

It would appear that the most improved methods of working coal practised in this country are also adopted at the great coal mines of Pennsylvania. The descent is often by shafts, with an inclination of 55°. They have, as with us, a subterraneous road, called the highway, to which the coal is brought by branches, and it is raised by the methods which we adopt.—The price of the anthracite is $6½ in Philadelphia, and $7½ in New York, per ton of 2000 lbs.; but wages are rising at the collieries, and labourers, who three years ago only received from 87½c. to $1, are now paid from $1 to $1½ per day.

Great quantities of the coal of this region are carried by the railway from Pottsville, through Reading, to Philadelphia, generally known as the Reading Railway. Much English capital is invested in this company, and as it is believed that the present floating debt will be absorbed by the profits in about a year, the stock has recently advanced from 31 to 36½. The details respecting a railway almost entirely dependent for its prosperity on its coal traffic are curious. Its working stock consists of 105 locomotive steam-engines; general freight cars, 684; passengers' cars, 40; coal cars, 4792. The receipts from the road, in 1853, were $2,688,283, of which passengers contributed $225,783; merchandise, $180,612; and coal, no less than $2,254,694—a state of traffic contrasting strangely with the railway returns of England. We are assured that recently no fewer than 2500 cars, each containing 4½ tons, were in one day sent down the road from Pottsville and Schuylkill Haven to Philadelphia, Richmond. The present freight to Philadelphia is $2¼ per ton, and the receipts are frequently $20,000 per day.

Railways in America necessarily possess vast advantages over canals for the carriage of coal, railways being open and in action all the year, while canals are closed by ice all the winter. and as the coal railways of the American Union promise well, we are glad to learn that a large proportion of their stock and bonds is held in England. The Reading Railway has been the cause of converting the upper part of the city of Philadelphia, called Richmond, into an American Newcastle-upon-Tyne, and a fleet of coal vessels is now to be constantly seen lying there.

The canals communicating with the Pennsylvania coal field appear to be also highly prosperous, and the details which we have thus in a condensed form presented to our readers, must satisfy them that, however great and rapid the general advance of the United States has been, the singular increase, within a limited and defined period, of the anthracite coal trade, is probably the most striking and remarkable feature which it presents to our consideration.—*Mining Journal.*

The Report on Railways for 1853.

BY CAPTAIN GALTON, R.E.

The length of new lines of railway sanctioned by the legislature in the United Kingdom during the year 1853, was 940 miles, which amount is very considerably greater than that sanctioned during any year since 1847. Of this amount 589 miles were in England, 80 miles in Scotland, and 271 miles in Ireland.

Among the most important of the new lines in England appear to be the following, viz:—A line from Strood to Canterbury, by which the communication by railway along the south bank of the Thames will be rendered continuous as far as the North Foreland. The Portsmouth railway by which a direct communication will be afforded between Portsmouth and the metropolis. An extension of the Midland railway from Leicester to Hitchin on the Great Northern Railway, by which a second line of communication will be afforded from the Midland districts to the metropolis, and the Worcester and Hereford Railway, by which a more direct road will be opened between the Midland Counties and South Wales.

In Ireland the most important line would appear to be the Londonderry and Coleraine Railway, by which a direct route will be afforded between Belfast and Londonderry; and the Londonderry, Coleraine, and Sligo Railway, which will afford a direct railway communication from Sligo to Londonderry and to Dublin.

The total length of railway which has been authorised by Parliament to the end 1853 is 12,688 miles. Of this number of miles 7686 have been opened for traffic, leaving 5002 miles to be completed; but the compulsory powers of 2838 miles have expired without being exercised, or the railways being opened to the end of 1853. The length of railways for the construction of which Parliamentary power exists is 2164 miles. The length of railway opened previously to December 1843, was 2036 miles. The length opened in the year 1844 was 204 miles; in 1845, 296 miles; in 1846, 606 miles; in 1837, 803 miles; in 1848, 1182 miles; in 1849, 869 miles; in 1850, 625 miles; in 1851, 269 miles; in 1852, 446 miles; in 1853, 350 miles; making the total length then opened 7686 miles; of which 5848 miles are in England, 995 in Scotland, and 843 miles in Ireland. The length of narrow guage railway, including the Irish guage of 5¼ feet, is 6965 miles, of the broad guage 626 miles, and of the mixed guage 95 miles. The number of railway companies having single lines of railway at the end of 1853 was 97, the length of single narrow gauge lines, including the Irish gauge, 1543 miles, of broad gauge, 112 miles, and of mixed guage 53 miles—total, 1708 miles; of which 1135 miles of single line are in England, 132 miles in Scotland, and 441 miles in Ireland.

Of the single lines opened at the end of the year 1852, 32 miles 46 chains in England, and 41 miles 76 chains in Ireland, have been made double during the year 1853.

The total length of new lines which were opened during the year 1853 amounted to 350 miles.

Of the lines opened in England, the principal ones are—the Oxford, Worcester, and Wolverhampton railway from Wolvercot to Evesham, by which the manufacturing districts near Birmingham, the town of Worcester, and the important agricultural districts between Worcester and Oxford are accommodated with a direct route to London; the Newport, Abergavenny, and Hereford Railway, by which a direct route is afforded from Birkenhead to South Wales; and the Thirsk and Malton, and Malton and Driffield Railways, by which railway communication is afforded to an important district in Yorkshire.

In Scotland the only line of importance opened for traffic was the Deeside Railway. In Ireland the most important lines are the Waterford and Kilkenny, and Waterford and Limerick Railways, by which Waterford has been connected with the Irish railway system; and the railway from Killarney to the Great Southern and Western Railway.

All these lines of railway were inspected, previous to being

opened for traffic, by officers of the Railway department of the Board of Trade, who required the opening to be postponed in twenty-eight instances. The total number of inspections which were required to be performed by the officers amounted to fifty-eight.

Of the railways opened during 1853, twenty-five portions of railway, representing a total length of 298 miles, consisted of single line open at the end of 1853, viz., 1708 miles, was between one-fourth or one-fifth the whole amount of railway open. It is to be observed that the length of single line open at the end of 1852 was 1485 miles, and at the end of 1851, 1307 miles. A single line of railway cannot be worked with safety except under special regulations, so framed as to prevent the possibility of engines or trains moving in opposite directions, from meeting on the single line; such regulations are, however, inconsistent with a large amount of traffic. In all cases of single lines opened during 1853, the regulations required generally either that the trains should be worked by means of one engine moving backwards and forwards over the line, or over particular portions of it; or that some particular man should be appointed to accompany the trains moving over the portions of single line. And in cases where the electric telegraph is in use, the regulations required were, that the persons employed to start trains should be distinctly responsible for ascertaining, before starting the trains, that the line is clear so far as the next station.

The amount of capital invested in railways at the end of 1852 was £264,165,680, of which £161,400,256 consisted of ordinary capital, £38,700,655 of preference capital, and £64,064,668 of loans. The amount of capital raised for railway purposes in 1849, was £29,574,720; in 1850, £10,522,967; in 1851, £7,970,151; and in 1852, £16,398,993; thus increasing the amount invested in railways at the end of 1849 from £229,747,778 to £264,165,680 at the end of 1852. The amount of money which was raised by railway companies during 1853 has not yet been returned to Parliament; but it may be assumed not to have been less than that raised during 1852, and it is therefore probable that the whole sum raised by railway companies to the end of 1853 is not less than £281,000,000, of which about £42,000,000 may be assumed to have been preferential capital, and nearly £70,000,000 would appear to have been borrowed on the security of the undertakings.

The number of miles of railway in course of construction on the 30th of June, 1853, was 682 miles, and the number of men employed on them was 37,764. The number of miles open for traffic at that date was 6512, and the number of men employed, 80,409. The number of men employed on railways open for traffic was 9·5 per mile in 1852, and 10·7 per mile in 1853.

The total number of passengers conveyed on railways in the United Kingdom in the year 1853 amounted to 102,286,660; the number in 1852 had been 89,135,729. The total receipts from all sources of traffic amounted in 1853 to £18,035,879, and in 1852, to £15,710,554.

The receipts from goods have increased from £4,750,504 in 1849, to £8,112,477 in 1853, being an increase of from £1090 per mile, in 1849, to £1415 per mile, in 1853; and whilst the receipts from passengers in 1849 were larger than the receipts from goods in the proportion of 53·42 to 46·48, in 1853 the contrary was the case, viz., the per centage of the passenger traffic was 47·45, and of the goods traffic 52·55.

In Scotland the progress of traffic on railways has been similar. The mean length of railway open during the year has increased from 795.5 miles open in 1849, to 987 miles open in 1853. The number of passengers conveyed in 1849 amounted to 7,902,228, and in 1853 to 10,999,224, which represents 9993 per mile in 1849, against 11,246 per mile in 1853. The relative number of passengers of each class conveyed would appear to have slightly varied, the number of first and third-class passengers having increased, and the number of second-class passengers having diminished, the number in 1849 being 720 first-class passengers per mile, 2035 second class passengers per mile, and 6997 third-class passengers per mile, against 1107 first-class, 1971 second-class, 8165 third-class passengers per mile in 1853. The receipts from passengers having increased from £540,778 to £697,712; or from £680 per mile, in 1849, to £713 per mile in 1853; and the proportion of receipts from each class conveyed having been in 1849, £149 per mile for first-class, £196 per mile for second-class, and £331 per mile from third class passengers, against £181 per mile from first-class, £179 per mile from second-class, and £345 per mile from third-class passengers in 1853.

It would, therefore, appear that in Scotland the third-class traffic preponderates considerably both as regards numbers and receipts. There is also in the Scotch lines a preponderance in the receipts from goods traffic over the receipts from passenger traffic.

The amount received from goods in 1849 was £650,640, and in 1853 it was 1,068,016, representing £818 per mile in 1849, against £1075 per mile in 1853. The relative proportions of the two descriptions of traffic were, in 1849, passenger traffic 45·38, and goods traffic 54·62; and in 1853 the receipts from goods traffic amounted to 60·48 per cent. of the whole. traffic.

The mean length of railway opened in Ireland in the year 1849 was 428 miles, and in the year 1853 it was 771 miles.

The total number of passengers conveyed in 1849 amounted to 6,059,947, or 14,142 per mile; and in 1853 it amounted to 7,074,475, or 9175 per mile.

The receipts from goods are also largely increasing, and they bear every year an increasing proportion to passenger traffic.

With respect to accidents, it appears that in 1852, 217 persons were killed, and 486 injured on the railways in the United Kingdom out of a gross total of 89,135,729 passengers; of these persons 181 were killed and 413 were injured in England; 24 were killed and 71 injured in Scotland; and 11 were killed and 2 injured in Ireland. In the year 1853, out of a gross total of 102,286,660 passengers conveyed by the railways of the United Kingdom, 305 were killed, and 449 injured; of these 243 were killed and 369 injured in England; 37 were killed and 68 injured in Scotland; and 25 were killed and 12 injured in Ireland.

On an Improvement in the Manufacture of Iron and Steel.

BY M. AUGUST LAUGEL, PARIS.*

Scientific revolutions are always caused by the discovery of some entirely new principle; industrial ones by a new and happy application of principles long known, but from which all the results have not yet been obtained.

* From the "Journal of the Franklin Institute."

I propose in this brief memoir to demonstrate the possibility of an industrial revolution in the United States with regard to the manufacture of cast iron, iron, and steel.

A few historical considerations must first be presented. It is universally known that iron was at first manufactured exclusively by means of charcoal with apparatus of small dimensions. This method precluded the preparation of large quantities, and it became quite insufficient when the introduction of steam-engines gave to industry so much wider a field. The immense importance of coal began to be recognised, and iron was manufactured by its means, according to new methods, which favoured its more rapid production in greater quantities.

A rivalry thus commenced between coal foundries and those kept up by wood, in which the latter were evidently to be overcome. The nations possessing great coal districts, particularly Great Britain, became the producers of iron for all the rest.

In these circumstances, if suddenly there should be discovered a new means of making iron with wood as rapidly and as economically as it is done at present with coal; if, besides, the iron thus prepared should offer in quality very great advantages in comparison with that made with coal; is it not natural to suppose that the consumers who are only attracted by the cheapness of English iron, would cease to employ it? Even admitting that under certain circumstances this iron would be dearer, they could more advantageously use it for those purposes for which iron of the first quality is indispensable, such as the manufacture of steel.

The country best situated for the success of this industrial revolution is undoubtedly the United States of America. For example, wood is found there in great quantities, and may in some places be obtained at a very low price: on the other hand, the beds of mineral iron are very numerous; modes of transport, always important in the working of iron, exist in great numbers. Here we find all the conditions necessary to success; it remains only to establish with certainty the advantage of this new method of manufacturing iron, and to explain its high importance.

1st. Wood is not charged with those mineral substances which injure at once the calorific effect and the quality of the metals fabricated by it. Coal contains often ten per cent. of matters either useless or injurious. Wood, on the contrary, contains hardly one-half per cent. of mineral substances, which besides are never injurious. All wood has great chemical uniformity, while coals differ much from each other, which involves the disagreeable necessity of ranging the methods of employing them. It is well known to metallurgists that wood should not be employed as a combustible without previous preparation, on account of the large proportion of water which it contains.

For many years the most various experiments have been made to prepare the wood before using it as a combustible. The method to which we would now call attention has been used for a short time in Styria and Carinthia, which consists in taking from the wood only the water, and stopping the distillation as soon as the substances which begin to escape contain carbon. Two methods have been used to effect this conversion of wood into *ligneux* (lignum).

1st. The gases coming from the fire-place are brought into immediate contact with the wood; thus the wood is raised to a temperature above 100° Centigrade, which favours still more the vaporisation by the tendency the gases themselves have to be saturated with vapour.*

In the second method, only the heat radiating from the gases in the fire-place is employed. These gases are not brought into immediate contact with the wood, but are conducted in pipes of cast or sheet iron, around which the wood is piled.

This second method affords by far the most satisfactory results, being the more economical, and avoiding the disadvantage which sometimes attends the first, of making the *ligneux* pyrophoric, and thereby liable to spontaneous combustion on exposure to the air.

It is important to render the second method still more perfect. The following means might be advantageously employed:—The combustion of the wood employed effects the conversion into *ligneux*, which is thus raised to a temperature of 150° Centigrade. All the water contained in this wood escapes in vapour; but the heat contained in this vapour and in the *ligneux* should be made useful, as well as the latent heat contained in the vapour. For this three successive chambers will be necessary. The wood loaded on waggons, passes in succession from one chamber to another. In the first chamber the wood will begin to be heated and to dry by means of the latent heat of the vapour, disengaged in the second, and condensed in the third; and also, by means of the latent heat of the air, cooled in the third, and brought back to the first. It is in the second chamber that the entire conversion of the wood into *ligneux* takes place; the *ligneux* will pass into the third chamber to cool; the heated air will be conducted to the first chamber to heat another load of wood; the vapour which is found there, and which comes overheated from the second chamber, will be condensed, and thus will give more heat to the first chamber, with which it communicates by pipes.

In following the preceding method, it is possible to change 10 parts of wood (standing for 1·00 of *ligneux*, 0·40 of water) into *ligneux*, by means of one part of wood employed as a combustible.

There is another method more economical which might be employed to convert the wood into *ligneux*. It consists in utilising the wasted flame of the metallurgic apparatus, after having of course previously used it for other purposes; for example, heating the cauldrons; because on coming from the apparatus the gas is of too high a temperature for the operation in question, and is still sufficiently hot after having been employed for the previous processes. But this method, by which economy is carried to the utmost extent, though very suitable in France or Germany, does not seem necessary in America, on account of the cheapness of the vegetable combustible.

Thus far we have only explained, and very briefly, the first part of the new method of manufacturing iron. We now come to the second part, which is the *puddling process* with *ligneux*. The puddling, it is well known, is effected by burning in a reverberatory furnace the combustible gases which come from a lateral fire-place. The important part of the operation is to conduct into the furnace a sufficient quantity of air to produce a total combustion of the gaseous substances. Generally too much air is admitted, which has the disadvantage of uselessly absorbing the heat. Mineral combustibles are much better

* It is unnecessary in this memoir to describe either the chamber in which this process takes place, or the requisite apparatus and details of the different processes.

adapted than wood to the operations of the puddling furnace, on account of their superior density; they develop a greater quantity of heat, and also produce a more regular current of gas; besides which, the interstices between the pieces of wood permit too much air to pass. In the new puddling process, the quantity of air introduced into the furnace is, so to speak, mathematically regulated; the combustible mixture, and the current of air which serves to ignite it, are admitted separately into the laboratory. Here the fireplace must be of entirely different dimensions. It is very long vertically; the grate is very low, and composed only of a few bars to support the wood; the air no longer enters freely into the fire-place; the bellows send a graduated current of air under the wood, which traverses it, producing its distillation. On account of the pile which the air is obliged to traverse, this distillation takes place, so to speak, in a gradual and progressive manner; the air thus admitted into the lower part is in proportion to the quantity of *ligneux* required to be carbonised in a given time. The current of combustible gas which is found in the pile of wood passes into the laboratory, where the puddling takes place, and is met by a current of air carefully regulated and driven through a pipe; thus the laboratory obtains, instead of an ordinary flame, a combustible gas, free from all traces of pure oxygen. Nothing is more easy, when one understands the composition of *ligneux*, than to know the exact quantity of air to admit into the furnace; but in what proportion shall the whole amount of this quantity be divided? How much shall go to the furnace, and how much to the laboratory? This is a question which experience alone can answer. We can only say in general that the latter proportion depends upon the more or less combustibility of the mixture of gases, and consequently on the temperature required in the furnace, the rapidity of the distillation and the operation itself.

This last term has evidently in all cases a limit, which fixes the proportion to be established between these two currents of air. Registers also connect them with each other, which can be managed by the workmen themselves. This mode of combustion is very remarkable, both theoretically and practically; it produces a very great regularity in the labour, and gives a current of very pure gas; the purification of the cast iron is thus effected under the most favourable circumstances, and even very impure kinds give excellent iron. It is quite otherwise, it is well known, with the ordinary method of puddling with coal, and we may assert in general, that the impurity of iron is attributable less to the cast iron than to the imperfection of the mode of reviving. In the United States the cast iron made with wood or anthracite would never be of a very bad quality;* the admirable perfection of the puddling with *ligneux* would warrant the excellence of the products of the new method. It now remains, and this is the main point, to consider the economical conditions of the question.

The following are the facts of the case, the exactitude of which we will warrant.

The consumption of cast iron, labour, and *ligneux* are per on of iron:—

Cast iron,		tons 1·242	
Labour	For the puddling,	days 3·86	11·35
	For forging and rolling,	" 4·69	
	Sundry processes,	" 2·80	
Ligneux	For the puddling,	tons 1·20	2·50
	For forging and rolling,	" 1·30	

* It remains to be seen, perhaps, if it would not be advantageous to manufacture the cast iron also with *ligneux*.

This estimate may serve to establish the *special* expenses in each particular case. In order to establish the *general* expenses, it will be necessary to obtain information on the following points:—

1st. The purchase of land.

2nd. The price of building materials, stones, bricks, clay, &c., &c.

It will be important, in order to diminish as much as possible the total amount, to choose a situation where wood is cheap and abundant, and in the neighbourhood of the mines, from whence the ore could be brought at a small expense (In case it should be preferable *not* to manufacture the cast iron, this last observation applies to the cast iron which it would be necessary to buy.) It is also important to take into account the means of transport of the produce to the great industrial markets, by canal or railroad; the price of labour, &c., &c.

It would be well perhaps to annex to the establishment a manufactory of cast steel; the *ligneux* would be very suitable for this species of manufacture, and it would be very easy to prepare for this purpose iron of the best quality. The establishment of the works required by this new method must be on a very large scale; its success depends almost entirely on the employment of the most economical means of manufacturing *ligneux;* this condition can only be fulfilled by preparing the *ligneux* in great quantities, and consequently the metallurgic apparatus must be very numerous.

The solution of this problem which we have been examining is in the highest degree important to the future progress of industry in the United States. It will enable them to employ to advantage the mineral wealth scattered over their territory, and upon a point of the utmost consequence will render them independent of other nations. It therefore eminently deserves the attention of the metallurgist and the manufacturer.

On Silica and some of its Applications to the Arts.*

BY REV J. BARLOW, M.A., F.R.S., V.P.R.I.

Silica is one of the most abundant substances known. Quartz, common sand, &c., flint, chalcedony, opal, &c., and a variety of sand described by Mr. J. T. Way,† may respectively be taken as examples of crystallised and uncrystallised silica. Under all these forms silica is capable of combining with bases as an acid. Heat is however essentially necesssary to effect this combination, a combination of which all the well-known silicates, whether natural, as feldspar, mica, clay, &c., or artificial, as glass, &c., are the results. The common forms of insoluble glass are produced by the union of silica with more than one base. But, when combined with an alkaline base only, silica forms a soluble glass, the degree of solubility of which depends on the proportion which the siliceous acid bears to this alkaline base. This soluble silicated alkali (or water-glass) may be prepared by various processes. If sand be used, 15 parts of find sand, thoroughly incorporated with 8 parts of carbonate of soda, or with 10 of carbonate of potass and 1 of charcoal, fused in a furnace, will produce a silicated alkali which is soluble in boiling water. Messrs. Ransomes obtain

* Substance of a Lecture delivered at the Royal Institution of Great Britain, April 7, 1854.

† Quarterly Journal of Chemical Society, July 1, 1853, and Journal of Royal Agricultural Society, Vol. xiv. p. 1.

this silicated alkali by disolving broken flints in a solution of caustic alkali at a temperature of 300° Fah.* And, more recently, Mr. Way has observed that the sand which he has described will combine with caustic alkali at boiling heat, also producing a water-glass.

This water-glass has been applied to several important purposes, three of which were specially noticed.

1. *To protect building-stones from decay.* The stone surfaces of buildings, by being exposed to the action of the atmosphere, become liable to disintegration from various causes. Moisture is absorbed into their pores. The tendency of their particles to separate, in consequence of expansion and contraction, produced by alternation of temperature, is thus increased. Sulphurous acid is always present in the atmosphere of smoke-burning cities, and cannot but corrode the calcareous and magnesian ingredients of oolites and dolomites. It is true that good stone resists these sources of injury for an indefinite time, but such a material is rarely obtained. As a preventive of destruction, whether arising from physical or chemical causes, it has been proposed to saturate the surfaces of the stone with a solution of water-glass.

It is well known that the affinity of silica for alkali is so feeble that it may be separated from this base by the weakest acids, even by carbonic acid. According to the expectation of those who recommend the silication of stone, the carbonic acid of the atmosphere will set the silica free from the water-glass, and the silica, thus separated, will be deposited within the pores and around the particles of the stone. The points of contact of these particles will thus be enlarged, and a sort of glazing of insoluble silica will be formed sufficient to protect the stone against the effect of moisture, &c. This cause of protection applies chiefly to sandstone. But wherever carbonate of lime or carbonate of magnesia enters notably into the composition of the building-stone, then an additional chemical action, also protective of the stone, is expected to take place between these carbonates and the water-glass. Kuhlmann † remarks "Toutes les fois que l'on met en contact un sel insoluble avec la dissolution d'un sel dont l'acide put former avee la base du sel insoluble un sel plus insoluble encore, il y a echange; mais le plus souvent cet echange n'est que partiel." In consequence of this "partial exchange" an insoluble salt of lime may be looked for whenever a solution of water-glass is made to act on the carbonate of lime or carbonate of magnesia existing in oolitic or dolomitic building-stone.

This expectation, however, has not been altogether sanctioned by experiment. A gentleman, eminently conversant with building materials,‡ immersed a piece of Caen stone in a solution of a silicate of potass in the month of January, 1849. This fragment, together with a portion of the block from which it had been separated, was placed on the roof of a building in order that it might be fully exposed to the action of atmosphere and climate. After four years the silicated and the unsilicated specimens were found to be both in the same condition, both to be equally corroded. These specimens were exhibited in the theatre of the Institution. But whatever ultimate results may ensue from this process, the immediate effects on the stone are remarkable. Two portions of Caen stone were exhibited, one of which had been soaked in a solution of water-glass two months before. The surface of the unsilicated specimen was soft, readily abraded when brushed with water, and its calcareous ingredients dissolved in a weak solution of sulphurous acid. The silicated surface on the other hand, was perfectly hard, and resisted the action of water and of dilute acid when similarly applied.§

II. Another proposed use of the water-glass is that of *hardening cements mortars*, &c., so as to render them impermeable by water.

Fourteen years since, Anthan|| of Prague proposed several applications of the water-glass. Among others he suggested the rendering mortars waterproof. He also suggests that this substance might be beneficially employed as a substitute for size in whitewashing and staining walls. It was demonstrated by several experiments that carbonate of lime mixed up with a weak solution of water-glass and applied as a whitewash to surfaces, was not washed off by sponging with water, and that common whitewash laid on in the usual manner with size, was rendered equally adhesive when washed over with water-glass.

III. *The Stereochrome of Fuchs.*

The formation of an insoluble cement by means of the water-glass, whenever the carbonic acid of the atmosphere acts on this substance, or whenever it is brought in contact with a lime-salt, has been applied by Fuchs to a most important purpose. The stereochrome is essentially the process of fresco secco¶ invested with the capability of receiving and perpetuating works of the highest artistic character, and which may be executed on a vast scale. Fuch's method is as follows**:—

"Clean and washed quartz-sand is mixed with the smallest quantity of lime which will enable the plasterer to place it on the wall. The surface is then taken off with an iron scraper in order to remove the layer formed in contact with the atmosphere, the wall being still moist during this operation. The wall is then allowed to dry; after drying it is just in the state in which it could be rubbed off by the finger. The wall has now to be fixed *i. e.*, moistened with water-glass.†† (An important point is not to use too much water-glass in the moistening the wall.) This operation is usually performed with a brush. The wall must be left in such a condition as to be capable of receiving colours when afterwards painted on. If, as frequently happens, the wall has been too strongly fixed, the surface has to be removed with pumice and to be fixed again. Being fixed in this manner, the wall is suffered to dry. Before

* Report of a communication made to the Royal Institution by Prof. Faraday, May 26, 1848. *Vide* Athenæum, June 17, 1848.

† Experiences Chimiques et Agronomiques, p. 120.

‡ Charles H. Smith, Esq., one of the Authors of the "Report on the Selection of Stone for the building of the New Houses of Parliament."

§ Siliman's American Journal, January, 1854, contains a notice of the application of the water-glass to the decaying surfaces in the Cathedral of Notre Dame in Paris.

|| Neuere Mittheilungen uber die Nutzanwendung des Wasser-glases 1840. This subject has been fully treated by Kuhlmann in his "Memoire de l'Intervention de la potasse ou de la soude dans la formation des chaux hydrauliques," &c. 1841. Experiences Chimiques et Agronomiques.

¶ Vide Eastlake's Materials for a History of Oil Painting, p. 142.

** These particulars were obtained by Dr. Hofmann from Mr. Echter. A stereochromic picture by Echter, and a sample of the water-glass as prepared by Fuchs, were also exhibited by Dr. Hofmann.

†† The composition of the specimen produced was—Silica, 23·21 per cent.; Soda, 8·90 per cent.; Potass, 2·52 per cent.; and the specific gravity of the solution was 3·81.

the painter begins he moistens the part on which he purposes to work with distilled water, squirted on by a syringe. He then paints; if he wishes to repaint any part he moistens again. As soon as the picture is finished, it is syringed over with water-glass. After the wall is dry, the syringing is continued as long as a wet sponge can remove any of the colour. An efflorescence of carbonate of soda sometimes appears on the picture soon after its completion. This may be removed, either by syringing with water, or may be left to the action of the atmosphere." Not to dwell on the obvious advantages possessed by the stereochrome over the real fresco, (such as its admitting of being retouched and its dispensing with joinings,) it appears that damp and atmospheric influences, notoriously destructive of real fresco, do not injure pictures executed by this process.

The following crucial experiment* was made on one of these pictures. It was suspended for twelve months in the open air under the principal chimney of the New Museum at Berlin; "during that time it was exposed to sunshine," "mist, snow, and rain," and nevertheless "retained its full brilliancy of colour."

The stereochrome has been adopted on a grand scale by Kaulbach, in decorating the interior of the great national edifice at Berlin already alluded to. These decorations are now in progress, and will consist of historical pictures† (the dimensions of which are 21 feet in height and 24½ feet in width,) single colossal figures, friezes, arabesques, chiaroscuro subjects, &c. On the effect of the three finished pictures, it has been remarked by one whose opinion is entitled to respect, that they have all the brilliancy and vigour of oil paintings, while there is the absence of that dazzling confusion which new oil paintings are apt to present, unless they are viewed in one direction which the spectator has to seek for.

Mr. A. Church has suggested that if the surface of oolitic stone (such as Caen stone) is found to be protected by the process already described, it might be used, as a natural intonaco, to receive coloured designs, &c., for exterior decoration; the painting would then be cemented to the stone by the action of the water-glass.

Mr. Church has also executed designs of leaves on a sort of terra-cotta, prepared from a variety of Way's silica rock, consisting of 75 parts clay and 25 of soluble silica. This surface, after being hardened by heat, is very well adapted for receiving colours in the first instance, and for retaining them after silication.

Phenomena Connected with the Motion of Liquids.

BY PROFESSOR TYNDALL.

The Lecturer commenced by referring to certain phenomena exhibited by liquids, and at variance with our commonly received notions as to their non-cohesive character. According to Donny, when the air has been, as far as possible, expelled from water by persistent boiling, such water possesses an extraordinary cohesive power, sufficient, indeed, to permit of its being heated at a temperature of 275° Fahr. without boiling. The adhesion of water, thus prepared, to the surface of a glass tube, was shown experimentally; the force being sufficient to sustain a column of water of considerable height. The contractile force of a soapbubble was referred to, and the lecturer passed on to the exhibition of the phenomena resulting from the shock of two opposing liquid veins. In this case, though the forces are in opposite directions, motion is not annihilated; but the liquid, as first shown by Savart, spreads out so as to form a thin transparent film, the plane of which is at right angles to the direction of the jets. By varying the pressure on one side or the other, or by making the jets of different diameters, the plane film could be converted into a curved one, and sometimes actually caused to close, so as to form a pellucid sack. A vein was caused to fall vertically upon a brass disk upwards of three inches in diameter. The liquids spread laterally on all sides, and formed an unbrella-shaped pellicle of great size and beauty. With a disk of an inch in diameter a pellicle of at least equal magnitude was formed. When a candle was placed underneath the curved sheet of water, a very singular effect was produced. The film above the candle was instantly dissipated, and on moving the candle, its motion was followed by a corresponding change of the aqueous surface. On turning a suitable cock, so as to lessen the pressure, the curvature of the film became increased, until, finally, the molecular action of the water caused it to form a curve returning upon itself, and exhibiting the appearance of a large flash. When the film completely embraced the vertical stem which supported the brass disk, a change in the form of the liquid flash was observed. The latter became elongated, and was sometimes divided into two portions, one of which glided down the vertical stem and was broken at its base. When the jet was projected vertically upwards, large sheets were also obtained. The jet was also suffered to fall into small hollow cones of various apertures, and the shape of the liquid sheet received thereby some beautiful modifications. The enclosed sides of the hollow cone gave the liquid an ascending motion, which, combined with the action of gravity, caused the film to bend, and constitute a work of great beauty.—*Lecture delivered at the Royal Institution.*

Determination of the per-centage of Tannin in Substances used for Tanning.

BY PROFESSOR FEHLING.

Among the various substances which precipitate tannin from solution, such as gelatin, quinine, animal skin, &c., the latter has hitherto been recommended as the most appropriate for determining the per-centage of tannin. This method of valuation has been preferred because it represents in miniature the operation to which the results refer. There are, however, no detailed directions for its application, and in repeated trials made by the author, under a variety of conditions, he has found that the tannin is never perfectly precipitated, and that the solutions soon become mouldy. Experiments with a solution of quinine, freshly precipitated oxide of iron or alumina, did not give more satisfactory results. He then tried gelatin in solution, and instead of weighing the precipitate obtained, by adding an excess of gelatin, preferred adopting the volumetrical method, estimating the quantity of solution of gelatin of known centigrade value required to precipitate the tannin. For this purpose it is indispensable that the precipitate should separate readily, but with most kinds of tannin this is not the case. The author has found it advantageous to use a dilute solution of gelatin, and to have the liquids quite cold. His mode of operating is as follows:—

* Communication from Mr. George Bunsen.

† Three of these pictures are finished, viz. 1. The fall of Babel; 2. Die Bluthe Griechenlands ('the golden age of Grecian art and poetry'): 3. The Fall of Jerusalem. (an engraving of this picture was exhibited by Mr. Ackerman).—Two other compositions are drawn, viz. 4. The battle of the Huns; 5. The Crusaders' arrival before Jerusalem.—6. This subject not yet decided on.

The solution of gelatin is prepared by digesting ten grm. of dry gelatin (containing about eighteen or nineteen per cent. of water) in water for twelve hours, and then applying heat until the solution is complete. The volume is then made up to one litre.

For the purpose of determining the centigrade value of the gelatin solution, 0·2 grm. of pure gallo-tannic acid dried at 212° F. is dissolved in 100 or 120 grm. of water, and the gelatin solution added from a graduated burette until the precipitation is complete. Filtration is generally necessary towards the end of the operation, or as a substitute the following plan may be adopted:—A narrow open glass tube is covered at one end with some tolerably thick linen bound tight by cord; on immersing this covered end into the liquid, and sucking out the air by the mouth at the other end, a portion is rendered clear by passing through the linen, and may be poured into a tube, and tested with gelatin.

The author found that the 0·2 grm. of pure dry tanno-gallic acid required from 32·5 cub. cent. of the gelatin solution for perfect precipitation; when the solution is some days old, a larger quantity is necessary, 35, 38, or even 40 cub. cent. It is therefore necessary in all cases, when the gelatin solution has been kept any time, to determine its centigrade value by means of gallo-tannic acid immediately before making any experiments with it.

If it is required to estimate the value of oak or other barks for tanning, they are first dried in a warm room, powdered finely, digested in quantities of 10 grms. with warm water, and exhausted by means of a displacement apparatus constructed of a tube two feet long, one inch wide, and drawn out at the lower end, which is loosely stopped with cotton wool. Some substances may be introduced dry into this apparatus, and exhausted by the warm or cold water. The extraction may likewise be facilitated by the pressure of a column of water applied by fitting a narrow glass tube with a cork into the upper end.

In most cases, the extraction is completed in one or two days. When the operation is properly conducted, the quantity of liquid extract amounts to half a pound or a pound. It is then treated with gelatin solution so long as a precipitate is produced. A few drops of dilute hydrochloric acid facilitate the separation of the coagulum.

The quantity to be taken for an experiment of substances rich in tannin, such as galls, is about 0·5 or 1·0 grm. A simple calculation gives the per. centage of tannin.

The author states that he has adopted this method in repeated examinations of tanning materials during the last ten years; he has found the results tolerably constant, and nothwithstanding its apparent imperfection, more trustworthy than any other yet known.

He estimates the relativo value of several substances of this kind as follows:—

Pine bark................	contains from	5 to 7	per cent.	tannin.
Old oak bark..........	"	9......	"	"
Best oak bark.........	"	19 to 21	"	"
Gall nuts.........	"	30 to 33	"	"
Aleppo galls...........	"	60 to 66	"	"
Chinese galls..........	"	70.......	"	"

These data at least admit of comparison with each other, and indicate with tolerably certainty the respective value of these substances to the tanner. This method of valuation is indeed based upon the assumption that the same kind of tannin exists in all these substances. It is however, extremely probable that this is not the case; but at the same time it may fairly be assumed that if different kinds of tannin combine under similar conditions with different quantities of gelatin, they will also combine with animal skins in the same relative proportions. If, therefore, this method does not indicate the absolute percentage of tannin, it still gives the per-centage value of the substances examined, and it is precisely this which the tanner requires.

It is another question whether gelatin solution preciptates all the substances of the tanning material which combine with the skin, and it therefore remains to be determined by experience whether such a method of valuation is sufficient for the purpose of the tanner.—*Polytechnisches Central Blatt*, 1853, *through Journal of Industry Progress.*

Twenty-fourth Meeting of the British Association for the Advancement of Science.

LIVERPOOL, SEPTEMBER, 1854.

On the Anthropoid Apes; by Prof. Owen.

The Lecturer defined the known species of those large tail-less Apes, which form the highest group of their order (Qaudrumana), and consequently make the nearest approach to man; he determined the true zoological characters of the known orangs and chimpanzees, as manifested by adult specimens; pointed out the relative proximity of the orangs and chimpanzees to the human species; and indicated the leading distinctions that separate the most anthropoid of those apes from man. The Professor then entered upon the subject of the varieties of the human species, and defined the degree in which the races differed from each other in colour, stature, and modifications of the skeleton. He entered upon a disquisition of the causes of these varieties, and proceeded to examine how far any of the known causes which modify specific characters could have operated so as to produce in the chimpanzees or orangs a nearer approach to the human character than they actually present. He pointed out some characters of the skeleton of the ape, *e. g.* the great superorbital ridge in the Gorilla Ape, which could not have been produced by the habitual action of muscles, or by any other known influence that, operating upon successive generations, produces change in the forms and proportions of bones. The equable length of the human teeth, the concomitant absence of any interval in the dental series, and of any sexual difference in the development of particular teeth, were affirmed to be primitive and unalterable specific pecularities of man. "Teeth," the Professor proceeded to state, "at least such as consist of the ordinary dentine of mammals, are not organized so as to be influenced in their growth by the action of neighbouring muscles; pressure upon their bony sockets may affect the direction of their growth after they are protruded, but not the specific proportions and forms of the crowns of teeth of limited and determined growth. The crown of the great canine tooth of the male *Troglodytes gorilla* began to be calcified when its diet was precisely the same in the female, when both sexes derived their sustenance from the mothers'smilk. Its growth preceded and was almost completed before the sexual development had advanced so as to establish those differences of habits, of force, of muscular exercise which afterwards characterize the two sexes. The whole crown of the great canine is, in fact, calcified before it cuts the gums or displaces its small deciduous predecessor; the weapon is prepared prior to the development of the forces by which it is to be wielded; it is therefore a structure foreordained, a predetermined character of the chimpanzee, by which it is made physically superior to man; and one can as little conceive its development to be a result of external stimulus, or as being influenced by the muscular actions, as the development of the stomach, the testes, or the ovaria." The difference in the time of disappearance of the suture separating the premaxillary from the maxillary bone, was not explicable on any of the known causes affecting such character. There was not, according to the Lecturer, any other character than those founded upon the developments of bone for the attachment of muscles, which was known to be subject to change through the operation of external causes; nine-tenths, therefore, of tho differences, especially those very striking ones manifested by the pelvis and pelvic extremities, which Pro. Owen had cited in his 'Memoirs on the Orangs and Chimpanzees,' published in the *Zoological Transactions*, as distinguishing the great chimpanzee from the human species, must stand in contravention of the hypothesis of transmutation and progressive develepement, until the supporters of that hypothesis are enabled to adduce the facts and cases which demonstrate the conditions of the modifications of such characters. There was the same kind of difficulty in accounting for the distinctive characters of the different species of the orangs and the chimpanzees, as for those more marked distinctions, that remove both kinds of apes from man. And with regard to the number of the known species, Prof. Owen remarked, it is not without interest to observe, that as the generic forms of the Quadrumana approach the Bimanous order, they are represented by fewer species. The gibbous (Hylobates) scarcely number more than half-a-dozen species; the orangs (Pithecus) have but two species, or at most three; the chimpanzees (Troglodytes) are represented by two species. The unity of the human species is demonstrated by the constancy of those osteological and dental characters to which the

attention is more particulary directed in the investigation of the corresponding characters in the higher Quadrumana. Man is the sole species of his genus—the sole representative of his order: he has no nearer physical relations with the brute-kind than those which arise out of the characters that link together the great group of placental mammalia, called "Unguiculata." In conclusion, the Professor briefly recounted the facts at present satisfactorily ascertained respecting the antiquity of the Quadrumana and of man upon the surface of the earth. At the time of the demise of Cuvier, in 1832, no evidence had been obtained of fossil Quadrumana, and the Baron supposed that both these and the Bimana were of very recent introduction. Soon after the loss of that great re-constructor of extinct species, evidence with regard to the fossil Quadrumana was obtained from different quarters. In the oldest (eocene) tertiary deposits in Suffolk, specimens of jaws and teeth were found, that unerringly indicated the former existence of a species of monkey of the genus Macacus (*Macacus eocenus*). About the same time, the tertiary deposits from the Himalayan mountains gave further evidence of the Quadrumana: jaws, astragali, and some other parts of the skeleton, having been found completely petrified, and referable to the genus called Semnopithecus, which is now restricted to the Asiatic Continent. Dr. Lund discovered in Brazil fossil remains of an extinct platyrhine monkey, surpassing any known Cebus or Mycetes in size: the platyrhines are peculiar to South America. Lastly, in the middle tertiary series in the south of France, was discovered a fragment of the lower jaw, proving that at that period some species of the long-armed ape (Hylobates) must have existed. But no fossil human remains have been found in the regularly deposited layers of any of the divisions (not even the pliocene) of the tertiary series. Human bones have been found in doubtful positions, geologically considered, such as deserted mines and caves, in the detritus at the bottom of cliffs, but never in tranquil, undisturbed deposits, participating in the mineral characters of the undoubted fossils of those deposits. The petrified Negro skeletons in the calcareous concretes of Guadalope are of comparatively recent origin. Thus, therefore, in reference both to the unity of the human species, and to the fact of man being the latest, as he is the highest, of all animal forms upon our planet, the interpretation of God's works coincide with what has been revealed to us as to our own origin and zoological relations in his Word. Of the nature of the creative acts by which the successive races of animals were called into being we are ignorant. But this we know, that as the evidence of unity of plan testifies to the oneness of the Creator, so the modifications of the plan for the different modes of existence illustrate the beneficence of the designer. Those structures, moreover, which are at present incomprehensible, as adaptions to a special end, are made comprehensible on a higher principle, and a final purpose is gained in relation to human intelligence; for, in the instances where the analogy of humanly invented machines fails to explain the structure of a divinely created organ, such organ does not exist in vain, if its truer comprehension in relation to the Divine idea lead rational beings to a better conception of their own origin and Creator.—The discourse was illustrated by drawings and diagrams of the principal external and osteological characters of the different species of orangs and chimpanzees, and of the different varieties of the human race.

On Luminous Meteors: by PROF. POWELL.

The Report consists almost entirely of details of observations on appearances of meteors, collected and communicated by various observers who have in former years contributed to the Reports successively printed in the volumes of the British Association. The observations are chiefly from Mr. E. J. Lowe, Mr. King Watts, the Rev. J. B. Reade, Mr. Bulard, and Mr. Farel, the latter of whom accompanies his observations by beautifully-executed diagrams, giving projections of the sky, with the paths of the observed meteors. Considerable discussion has taken place on the subject,—of which some account was given in the report,—between MM. Coulvin-Gravier and G. Von Boguslawski, more especially on the constancy of the August periodical shooting-stars, which had been denied by M. Coulvin-Gravier. It appears to have been perfectly verified in the last year. An unusual number seem also to have been observed on the 17th of October. Also a very remarkable large meteor was seen over a large part of England on the 28th of October.

Mr. Greg read a paper on 'Meteorolites and Asteroids,' in which he brought forward some circumstances in connexion with those bodies, not hitherto noticed, in favour of the theory that they are identical in nature and origin. After stating some arguments against the theory of the atmospheric origin of ærolites, Mr. Greg proceeded to give an abstract of some results he had lately obtained in analyzing a very complete catalogue of ærolite falls. It would appear that since the year 1500 A.D. there are 175 authenticated instances of falls of ærolites, the month of whose fall is known. The number for each month being as follows:—For January 9, February 15, March 17, April 14, May 15, June 17 falls,—first half of the year, 87 falls; July 18, August 15, September 18, October 14, November 16, December 7 falls,—second half, 88 falls. Giving an average of 14·6 for each month. The most important thing to notice is the small number of ærolites registered for the months of December and January, and the comparatively large number for June and July. The former two showing but 16 instances of falls, the latter two 35, or more than double. Now, granting that these ærolites, or meteorolites, belong to the system of the asteroids, having orbits therefore whose mean distance is superior to the earth's orbit, it is certainly reasonable to conclude, than it is when the earth is farthest from the sun, *i. e.* at her aphelion, that the meeting with ærolities is rendered most probable. This is what would appear really to be the case, for the earth is at her greatest distance from that luminary on the side of the summer solstice, *i.e.* in June and July, precisely the months shown to be most abundant in ærolites. Mr. Greg then referred to a recent number of the *Comptes Rendus*, in which there is a paper by Le Verrier on the asteroids. M. Le Verrier shows by calculation that the sum of the mass of the fragmentary planets called asteroids cannot exceed one-fourth of the earth's mass; and also shows it probable that their mean mass or system is at its perihelion, and consequently nearest the earth, at the time when the earth herself is on the side of the summer solstice. This would appear again confirmatory of the theory that ærolites are the minute outriders of the asteroids. There would appear to be also further evidence, though of another kind. It has been supposed that some of the larger asteroids have irregular and angular surfaces, which is precisely the case with the majority of the meteoric stones which fall to the earth. Again, taking the average specific gravity of ærolites at 3·0 (they vary from 1·7 to 3·9), further indirect evidence is afforded as to their position with regard to distance from the sun, and, taking water as 1·0, the following table shows the relative densities of several of the planetary bodies, following the order of their distances from the sun:—Mercury, 15·7; Venus, 5·9; Earth, 5·6; Mars, 5·2; Aerolites, 3·0; Asteroids, (?), Jupiter, 1·4. Another circumstance relating to ærolites which was alluded to by Mr. Greg was the periodicity of those bodies, and he mentioned more particularly the 19th of May, 29th of November, 13th of December, 15th to 19th of February, and 26th of July, as being ærolitic epochs, ærolite falls having been recorded on the following days:—February 10, 10, 13, 15, 15, 15, 18, 18, 18, 19, 19, 25, 27, 27; May 9, 10, 17, 17, 17, 18, 19, 19, 20, 22, 26, 26, 27, 28; July 3, 3, 4, 7, 8, 12, 14, 17, 18, 22, 24, 24, 26, 26, 26, 30; November 5, 7, 11, 13, 17, 20, 23, 25, 27, 29, 29, 29, 29, 30, 30; December 11, 13, 13, 13, 13, 13, 14. In referring, however, to the epochs most remarkable for the periodical displays of luminous meteors, as November and August 9th to 14th days, Mr Greg observed that the number of ærolites recorded as falling on those days is remarkably small, indeed under the average of the year, for out of 155 falls (the day as well as month of fall being known), but four have fallen between the 9th and 14th days of August and November. The ærolitic and (luminous) meteoric epochs also would appear to differ, with the exception of the 29th of November. From this circumstance it seems probable that ærolites, and the majority of luminous meteors (especially periodic and conformable ones), are resolvable into separate classes; and in corroboration of this it may be mentioned, that while the number of ærolites whose falls have been recorded are about equally divided for the first as for the second half of the year, this is very far from being the case with luminous meteors, by far the larger numbers of which are observed during the second half of the year, viz., from July to December. While, then, we consider ærolites as belonging to asteroids, with orbits superior to the Earth's and partaking of the nature of true though minute planets, the majority of luminous meteors may be considered as having characters more in common with comets. It has been shown by several astronomers, as Olmsted, Pierce, Erman, and others that the majority of periodic meteors have orbits inferior to the Earth's, and their perihelia near the planet Mecury. Mr. Greg concluded, after making some observations in favour of the self-luminosity of meteors, by suggesting the probability of their having a nature less dense than that of ærolites, but denser than that of comets, and that it is not improbable they have a fluid or viscid nature.

On some Peculiarities of the Magnetic field: by Professor Tyndall.

The Professor said, a piece of soft iron suspended between the flat poles of an electro-magnet set its largest dimension from pole, the residual magnetism of the cores being sufficient to produce the effect. This is the normal deportment of magnetic bodies, but it is by no means universal. By mechanical agency, by pressure for example, the structure of a magnetic body can be so modified that its shortest horizontal dimension sets from pole. Prof. Tyndall exhibited actions of the kind where the body operated on was compressed magnetic dust. In such a body two opposing tendencies were at work,—the tendency due to length, which sought to set the length axial, and the tendency due to structure, which sought to set the line perpendicular to the length axial. Between the flat poles the latter tendency was predominant, but between pointed poles this was not the case; here the attraction of the ends of the magnetic mass constituted a mechanical couple of sufficient strength to overcome the directive tendency which was due to structure, and to draw the mass into the axial line. But in raising or lowering the body operated on out of the sphere of this local attraction, by bringing it into a position where the distribution of the magnetic field resembled that existing between the flat poles, the body forsook the axial position and turned into the equatorial. The complementary phenomena were exhibited by bismuth. A normal bar of this substance sets its length at right angles to the line from the poles; but Prof. Tyndall exhibited a bar of this substance, which set between the flat poles exactly as a magnetic body. Such a bar, however, between the points set equatorial. On raising it or lowering it, however, it forsook the equatorial position and set axial. In this case the local repulsion of the ends between the points caused the bar to set equatorial, the influence of length thus predominating over the influence of structure; but removed from the sphere of this local action, the directive tendency of the mass triumphed and caused the bar to set axial. The bar in this case was cut with its length at right angles to the planes of most eminent cleavage of the bismuth:—it is a proved fact, that these planes while the influence of form is annulled, always set at right angles to the line piercing the poles, and hence where they are transverse to the length, the bar will set axial. These phenomena were examined in a great number of cases; bars were taken from substances possessing a directive tendency, and it was so arranged that the directive tendency due to structure was always opposed to the influence of length; between the points the former tendency succumbed to the latter, while between the flat poles, or above and below the points, the former was triumphant. It is amusing to observe the strife of these two tendencies in substances possessing a strong directive action. A plate of crystallized carbonate of iron, when properly suspended, will wrench itself spasmodically from one position into the other, and find rest nowhere. The simple law which governs all these actions is, that if the body, cut as above, be diamagnetic, its length sets equatorial between the points, but above and below them axial. If the body be magnetic it sets axial between the points, above and below equatorial. Hence the rotation of a magnetic body, on being removed from between the points, is always from axial to equatorial; while the corresponding rotation of a diamagnetic body is always from the equatorial to the axial. The deportment of wood in the magnetic field was next described. Nearly sixty specimens examined by Prof. Tyndall were all diamagnetic; each of them was repelled by the poles of the magnet; cubes of each when suspended with the fibre horizontal set between the excited poles, the fibre perpendicular to the line which unites the poles. Thinking that wood, on account of its structure, would exhibit those directive phenomena which had been demonstrated in the case of the bodies mentioned at the commencement, bars were taken from nearly forty kinds of wood, the fibre being at right angles to the length of the bar; in the centre of the space, between two flat poles, all those bars set their lengths from pole to pole. But Prof. Tyndall afterwards observed the remarkable fact, that homogenous diamagnetic bodies did the same. Bars of sulphur, of salt of hartshorn, of wax, and other diamagnetic substances, when suspended in the centre of the space between two flat poles, set their lengths from pole to pole. Now, as diamagnetic bodies always take up the position of weakest force, it was proved by these experiments, and corroborated by others not cited here, that the true force of the centres of the two flat poles contrary to the general opinion hitherto received, was the line of minimum force.

The Rev. Dr. Scoresby stated, that, by subjecting to force ordinary magnets of hardened steel, as by suddenly bending them, or striking them in particular modes, they may have their poles reversed or be deprived of their magnetism, or hardened non-magnetic steel may be instantly rendered magnetic and he considered that these facts, which he had long since made public, should be kept before the mind in such investigations as the very original and interesting facts just brought under the notice of the Section.—Prof. Faraday, after very briefly, yet lucidly, explaining to the Section the leading distinctions between paramagnetic and diamagnetic bodies, and their behaviour in the magnetic field, said that it was conceded on all hands that the explanation was erroneous, which Plücker had given of the phenomena which he first discovered connected with the branch of research to which Prof. Tyndall had just been directing their attention, and which he was so ably hunting down. But when he said the original explanation of Plücker was erroneous he did not mean that as the slightest disparagement to that philosopher. It was well understood by all who had any pretensions to scientific knowledge since the days of Bacon, that it was through the mist of error that the most important discoveries had to be made, and that in pursuing any research it was much better in the first stages of the inquiry to have erroneous views, than to be without any views that would tend to connect the scattered facts. For his part, he was not ashamed to own that he was a learner, and that in almost every instance it was through the clouds of error that he arrived at the conclusions which satisfied him most. And as his mathematical skill and acquirements were by no means such as to entitle him to despise instruction, he should feel particularly grateful to his mathematical friends present, Dr. Whewell and others, if they would explain to him and to the Section the law of distribution of the magnetic force in the magnetic field, if it was known.—Dr. Whewell explained how the force would be distributed upon the old theory of magnetic lines; but he said he was aware, and he believed it was now generally admitted, that this theory must be greatly modified, if not given entirely up. But as he saw Prof. W. Thomson in the Section, who had paid particular attention to the developement of the mathematical theory of magnetical and electrical forces, he trusted that that gentleman would favour the Section with his views.—In answer to Prof. Faraday's question, as to the mathematical conditions under which a uniform field of magnetic force may be produced, Prof. W. Thomson remarked that the mathematical theory of the distribution of force both afforded a remarkably simple and definite general answer, and pointed out the most convenient practical means of fulfilling these conditions either approximately or rigorously. For, in the first place, it is strictly demonstrable that if the force be rigorously uniform in some locality, in the neighbourhood of any kind of magnet or electro-magnet, through even one one-thousandth of a cubic inch, in fact, through any finite bulk however small, it cannot but be vigorously uniform through every portion of space to which it is possible to go from that locality without passing through the substance of the magnet. Hence, although between flat poles, such as Mr. Faraday first introduced for obtaining uniformity of force, we have in reality a most excellent practical approximation to a uniform distribution of very intense magnetic force, through a space of several cubic inches, in a locality not only visible but in every way convenient for experimental purposes; yet it is absolutely impossible that the force can be rigorously uniform through the smallest finite bulk of the magnetic field in any such arrangement, or generally, in any locality external to a magnet. If an experimenter wants a rigorously uniform field of force, he can only have it in the interior of his magnet; and he must be contented not to see the action he experiments on at the time it is being produced, unless he will follow the example of Prof. Faraday, who "went into a hollow cubical conductor of electricity and lived in it," and so was enabled to observe some most interesting and important fundamental properties of electrical force. It would be easy to make a hollow electro-magnet, in the interior of which the experimenter could observe with the minutest accuracy the bearings of all kinds and shapes of bodies in a vigorously uniform field of force. All that is necessary to make such a conductor is to take a hollow papier mâché globe, say six feet in diameter, and roll galvanic wire over its surface in a succession of close parallel circles, having their planes at equal distances from one another. A hollow non-magnetic body of any shape, cubical for instance, may have a rigorously uniform distribution of magnetic force produced in its interior by a suitable distribution of galvanic wire over its surface, determinable according to the form of this surface, by the mathematical theory from which these results are stated. But it would be difficult, perhaps practically impossible, to get a sufficient intensity for exhibiting the forces experienced by diamagnetic or weakly paramagnetic bodies in a uniform field of such extent that the operator could himself enter it; and experimenters must be contented either with approximations to uniformity, such as in the arrangement with flat poles, so successfully used by Prof. Tyndall in the beautiful experiments which he had ex-

hibited to the Section, or they must arrange to test effects in the interior of hollow electro-magnets without seeing them at the time they are taking place. Interesting questions, which the mathematical theory answers decisively, had also been asked regarding the minimum condition of the central line in a field between opposite flat poles, of two cylindrical soft-iron bar magnets, and the effects of rounding off the edges of these poles. It appears that, if we consider the intensity of the force in a plane perpendicular to the magnetio axis through the centre of the field, wo find it increasing from the central point to a certain circle of maximum intensity, beyond which it diminishes gradually and falls to nothing at an infinito distance. If the edges of the cylinders be rounded off, the circle of maximum intensity contracts, its centre always being a point of minimum intensity, until a certain degree of convexity of the poles is attained, when the circle of maximum intensity becomes comtracted to a point—the central point of the field —which will then be a point of maximum intensity (the central minimum being eliminated), and will continue a maximum, as regards all points in the plane through it, perpendicular to the axis, for any less flat or more prominent or pointed forms of poles. No form of rounded poles, by doing away with maximum or minimum points, can possibly give a uniform distribution of intensity through ever so small a finite bulk of the field.

On the Deviation of the Magnetic Needle peculiar to Liverpool, by Sir John Ross.

Ever since the year 1799, when my attention was first directed to the deviation of the magnetic needle, I have lost no opportunity of making observations in many parts of the globe, on the interesting phenomena appertaining to that influence,—a statement of which has been published by me in the narrative of my first two voyages of discovery to tho Arctic regions. Since which my attention was called to the frequent losses of ships consequent on the fallacious system adopted by the Admiralty, called "adjusting the compass," at Gravesend and other places; and after the loss of the Birkenhead, I felt it my duty to publish a pamphlet, which, although dedicated by permission to tho First Lord of the Admiralty, did not at once obtain their Lordships' approbation, inasmuch as it exposed the absurdity of the system then in practice under the superintendenco of a naval officer attachod to tho Admiralty. But I maintained tho trnth of my statement; and, after some correspondenco on the subject, my assertions wero found to bo correct, and, consequently, the office of Superintendent of Compasses was abolished, and circulars issued by the Admiralty, not only ordering a monthly examination of the deviation, but that such observation should be instituted at every change of the ship's position, and on every circumstance which was known or supposed to affoct the ship's doviation, or local attraction, which is now admitted to bo of infinite servico. But my attention has for some time been called to tho fact of ships sailing from the port of Liverpool, after having been swung in tho Mersey to obtain the amount of deviations, or as it is called, *to have their compasses adjusted*, that immediately on their proceeding on their voyage it was found that tho deviation observed in the Mersey was incorrect, and there have been lamentable instances of shipwreck in consequence. It has occurred to me that this untoward circumstanco is very easily explained. The fact is, that tho Mersey is not locality eligible for ascertaining the true deviation of the magnetic needlo, the ships being in a position between establishments in which large masses of iron aro deposited, which must have an influence on tho magnetic needle during the evolution of swinging the ship, while tho embarkation of passengers with their luggage, or anything else subsequent to that process, cannot but have the effect of producing a false and dangerous result to the observations. But this evil is not without an effectual remedy, which is within the power of every captain of a ship after ho has left tho port of Liverpool, and which will bo found in tho following proposals.—It is proposed that the present method of swinging the ship in the Mersey shall be continued; and, in order to obtain a verification or a correction of results observed at that time, it is proposod to placo on the sandhills of Rockland (near the Rock Lighthouse), two posts or boacons, truo north and south of each other, in the positions best seen near the red buoy of the Rock Channel, when the ships passing will bo steering about true west, or west-north-west, by compass. When these two objects can bo brought into one, *i.e.* duo north of each (both being south of the ship), either a verification of tho deviation that was observed in the Mersey, or tho amonnt of differenco to bo taken into consideration or account on that particular point of the compass, will bo shown, from which a calculation may be made in approximation of the other points; and if, further on, two other posts were erected on the magnetic meridian, the ships, on passing them, when in one with each other, could observe the exact amount of the deviation either in the increase or the diminntion of the variation on the course of the ship, keeping in mind that it will be on the south point of the compass that the observations will be made. Posts placed due south of Lizard Lighthouse would be useful, and also on the magnetic meridian. Bnt all posts or beacons denoting the true north or south bearings, and those further off denoting the magnetic meridian, should be painted of different colours. The former, that is, the true or nearest, should be red; while the latter, showing the magnetic meridian, should be chequered. Great Ormshead and Holyhead should have beacons placed on them, which would be observable to ships both outward and homeward bound.

On a New Refractometer: by Prof. Bennard.

This instrument was founded on the principle of passing a ray throngh a medium bounded by two parallel surfaces, and might be called the refractometer of separation (*refractometre de transport*). When a ray passes through such surfaces, if it be incident perpendicnlarly, it emerges in the same course. If it be incident obliqnely, its emergent course is parallel to that of its incidence. Then the relations which connect the perpendicular distance between the incident and emergent rays—the angle of incidence—the thickness of medium, or distance between the surfaces bounding it—the index of refraction is known—the first two can be observed, the third measured, and then the fourth—which is what we seek—is a matter of simple calculation.

Dr. Whewell expressed the pleasure he experienced at seeing these very beautifnl instruments; and was particnlarly struck with the clear proof arrived at by Prof. Bennard. that the light at the several parts of the solar spectrum was simple, and not compounded light; and that thus the view, which had been some years since propounded, and which was still entertained by some, that the spectrum obtained by the prism was composed of several superimposed spectra, is proved to be unfounded and must be abandoned.

On the influence of the Solar Radiations on the Vital Powers of Plants growing under different Atmospheric Conditions: by Mr. J. H. Gladstone.

This was the second Report given by the author under the same title, and commenced by describing accurately what portions of the prismatic spectrum were cut off by the various coloured glasses employed in his experiments. A series of observations followed on hyacinths grown under very varied influences of light, and solar heat and chemical agency. Among the results may be mentioned the power on the yellow ray to diminish the growth of rootlets, and the absorption of water; the power of the red ray to hinder the proper developement of the plant; and the effect of total darkness in causing a rapid and abundant growth of thin rootlets, in preventing the formation of the green colouring matter, but not of that of the blue flower, nor of the other constituents of a healthy plant. A series of experiments on germination was then detailed. Wheat and peas had been grown without soil under large colourless, blue. red, yellow, obscured colourless and obscured yellow glasses, and in perfect darkness. The effects resulting from these varied conditions were very marked; and the description of them occupies a considerable space in the report. The two plants experimented on—being chosen from the two great botanical divisions—exhibited a wide diversity, sometimes amounting to a direct opposition, in their manner of being affected by tho same solar ray; but in the case of both the plants, under the circumstances of the experiment, the following effects were observed:—The cutting off the chemical ray facilitates the process of germination, and that both in reference to the protrusion of the radicles, and the evolution of the plume; the stem grows unnaturally tall, and there is a poor developement of leaves in darkness, becoming more manifest as the darkness is more complete; and the yellow ray exerts a repellant influence on the roots, giving the wheat a downward and the pea-roots a lateral impulse. A few experiments on the germination of other seeds were then narrated; and the report concluded with an account of experiments on the germination of wheat and peas in oxygen, hydrogen, and carbonic acid gases, as well as in ordinary atmospheric air, and in air from which carbonic acid was at all times certain to be removed. The results confirmed former observations on the necessity of oxygen.

Prof. Miller, in thanking the author for his valuable researches, made some remarks on the interesting results that the investigation had brought to light; and drew especial attention to the remarkable fact stated in the paper, that the blue rays retarded the action of germination at first, although they probably accelerated the growth of the plant afterwards,—the act of germination being attended with the absorption of oxygen, but the process of developement being, on the contrary, attended with the extrication of this gas.—Prof. Anderson remarked that a similar difference in the rate of growth of the leguminous plants and grasses to that described by Mr. Gladstone had been observed when they were manured with the same material. Nitrate of soda, which was found to be an excellent fertilizer for grasses, had comparitively little influence upon leguminous plants.

On the Physiological Properties of some of the Compounds of the Organic Radicals—Methyl, Ethyl, and Amyl, by Dr. James Turnbull.

The author commenced by saying, that considering the vast number of new compounds discovered of late years, it was surprising that so few of real value should have been added by medical men to their stores of remedies. The progress of therapeutics, though disproportionately slow when compared with the advance of organic chemistry, was marked in our day by the discovery of a new and most valuable class of agents—the anæsthetics. The effect of this narcotic and the antiperiodic alkaloids, morphia and quinine, were well understood; but nothing was known of any relation that may exist between their chemical constitution and the different actions they exert on the animal economy. It is probable that an examination of the action of the artificial alkaloids upon the system would throw some light on this subject. Already one of them, Furfurine, has been found by Dr. Simpson to possess antiperiodic properties like quinine. The physiological properties of the pure hydro-carbons were then alluded to: several of them were stated to act as local and general stimulants, and some of the volatile ones had been found to possess anæsthetic properties, as had been demonstrated by Dr. Snow and Mr. Nunnerley with regard to benzine, and by the author with eupion and Persian naptha.

On the Physiological Properties of Carbazotic Acid: by Prof. C. Calvert.

The author stated that Dr. Bell, Physician to the Royal Infirmary, Manchester, had cured several cases of intermittant fever with this acid. He also said, that he should be very happy to furnish any physician with a small quantity of this substance, so that its real medical value might be ascertained. After describing the process by which pure carbazotic could be procured from carbolic acid he impressed upon the meeting the value of the pure acid as a yellow dye for silk.

Mr Warrington observed that carbazotic acid was first employed in silk-dyeing at Lyons—that in 1851 its price at Paris, where it was manufactured, was 10s. per lb.; and that if the grass tree or black bay gum (which could be imported into this country from Australia for 14s. per cwt.), were employed and treated with nitric acid (a process originally suggested by Dr. Stenhouse) he believed that it might be prepared for a shilling per lb.

On the Results of Experiments on the Preservation of Fresh Meat: by Mr. G. Hamilton.

This inquiry was undertaken with a view of discovering a method by which beef could be brought in a fresh state from South America. The experiments were made by inclosing pieces of beef in bottles containing one, or a mixture of two or more of the following gases:—chlorine, hydrogen, nitrogen, ammonia, carbonic acid, carbonic oxide, and binoxide of nitrogen. Of these, the last two only possessed the power of retarding putrefaction. Beef that had been in contact with carbonic oxide for the space of three weeks was found to be perfectly fresh, and of a fine red colour. Binoxide of nitrogen is capable of preserving beef from putrefaction for at least five months, during which time the beef retains its natural colour and consistence. When meat that had been preserved by the last process was cooked by roasting, it was found to possess a disagreeable flavour. If cooked by boiling, the ebullition must be continued for a much greater length of time than is necessary for fresh meat.

Dr. Calvert remarked, that he had opportunities of observing the well-known valuable anti-putrid properties of carbolic acid,—and instanced the case of the carcase of a horse that was at present in a fresh state, although four years had elapsed since it had been soaked in liquor containing the acid. He recommended the use of this acid for preserving bodies intended for dissection, as it neither affects the tissues nor discolours the organs.

On the Preservation of Milk; by the Abbe Moigno.

This was a description of the process invented by M. Mabbru, which consists in expelling the air and gases from milk by heating it in tinned or glazed iron cylinders to a temperature of 217°, in an atmosphere of steam.

On the apparently Mechanical Action accompanying Electric Transfer: by Mr. A. Crosse.

The author found that by electrifying a sovereign positively in close contact with a piece of carbonate of lime, under nitric acid diluted with fifty times its quantity of water, that a portion of the milled edge of the coin was struck off in pieces, some of which were large enough to retain the milled edge upon them distinctly. The voltaic action was kept up for fifty hours; and at the expiration of that time the coin had lost three grains in weight; and a ground glass rod that used to keep the coin in contact with the limestone was permanently gilded; and this took place at the positive pole. The weight of the portions removed from the coin exactly corresponded with the deficiency. The solution being tested contained nitrate of lime, but no gold nor copper. I likewise found on repeating this experiment with sulphuric acid, similarly diluted—the voltaic being kept up for ninety hours—that six grains of gold were removed from the edge of the coin; and the pieces broken off weighed the same. A strip of glass being placed on the edges of the jar containing the dilute acid, and half an inch above its surface, and in a line with the electric current, had its lower part covered with crystals of sulphate of lime, each one of which was at right angles to the electric current. The friction of the carbonic acid gas liberated from that part of the limestone in contact with the coin, was apparently the mechanical cause of the removal of the edges. The author stated that he had tried various experiments both with frictional and voltaic electricity upon different substances, which in his opinion proved the effects of the mechanical action accompanying electric transfer.

On the Action of Gallic and Tannic Acids on Iron and Alumina Mordants: by Prof. Calvert.

The author drew the following conclusions from the facts contained in his communication:—1st. That there can be no doubt that tannic acid is the matter in tanning substances which produces black with iron mordants; 2ndly. That the reason of gallic acid producing no black dye is, that it reduces the peroxide of iron in the mordant, forming a colourless and soluble gallate of protoxide of iron; 3rdly. That gallic acid has the property of dissolving hydrate of alumina, and also of separating alumina mordants from the cloth on which they are fixed; 4thly. That the reason of extracts of tanning matter losing their dyeing properties is, that the tannin is transformed into gallic acid; 5thly. That gallic acid possesses the property of dissolving iron, and thus lays claim to the character of a true acid; whilst tannin, not having this action, appears to me to be in reality a neutral substance.

On the Action of Citric, Tartaric and Oxalic Acids on Cotton and Flax Fibres under the Influence of Dry Heat and Pressure of Steam: by Mr. F. Grace Calvert.

Mr. Calvert has observed that when two to four parts of these acids are dissolved in 100 parts of water, and linen or cotton dipped into the solution obtained, and afterwards dried in the air, they, on exposure to certain temperatures, completely destroy the tenacity of the fibre. This action of organic acids is interesting when it is known that it takes place even at the low temperature of 180°, 212° and 260° Fahr. He also found that cotton and flax fibres when prepared as above, and then submitted to the influence of steam, of three lb. pressure, were destroyed.

On the Heating Effects of Secondary Currents: by Mr. J. P. Gassiot.

In January last Mr. Gassiot communicated to the Editor of the *Philosophical Magazine* an account of experiments made with Ruhenkooff's induction coil, and alluded to the fact, that the heating effect, which had already been noticed by Masson, took place in the contrary direction to that which is produced in the primary current, which

heating effect had been observed as far back as 1838. Since January last Mr. Gassiot has had several forms of apparatus constructed for the purpose of observing the phenomena of secondary discharge in relation to its heating effects:—1. If the discharge of the secondary current takes place in air the negative terminal (which in these experiments were of platina wire) became heated.—2. If the wires are sealed into small (thermometer) straight tubing neither terminal appears to be heated, but the discharge takes place, filling the entire tube with a brilliant clear white light.—3. If any part of the tube is blown into small bulbs that portion of the discharge which passes through the bulbs is spread as illuminating that portion with a brilliant blue light.—4. If the discharge takes place in a globe, or in a tube of about one inch diameter, the negative terminal is intensely heated. In the course of the experiments Mr. Gassiot noticed that the glass at the heated end became quite black; in fact, the heat of the electrode had fused the glass and reduced the lead. He, therefore, had another apparatus constructed, taking care that whenever he experimented with it the current should invariably be sent in the same direction. The result has been that the negative end has become quite black, the glass being apparently oxidized in regular layers, the most intense being nearest the wire. The positive end of the glass remains quite clean, as does the platina wire, except about 1-92 of an inch, which appears covered with a minute black deposit. At this terminal, whenever the discharge is made, a minute, but brilliant spark appears, from which the electric brush flows in great beauty and brilliancy. The negative is at first covered with the well known blue flames until it becomes red hot, or no deposit appears to remain in the negative terminal. In all the experiments made with closed glass tubes the air was exhausted by means of an air pump.

On the Structure of Lunar Volcanic Craters: by Mr. James Nasmyth.

This communication was illustrated by a model of the lunar volcano Copernicus, and a diagram of Simpelius; each of which consists of a plateau, with a small central cone, surrounded by a ring shaped elevation, exhibiting concentric ridges or terraces. The circular elevations were supposed to have been formed by the accumulation of materials erupted with great energy to various distances, according to the intensity of the force; giving rise to concentric ridges, or *terraces of deposition*, which are often nearly entire circles, one within the other. Besides these there are other terraces, forming only segments of circles within the principal rings, which were attributed to the agency of landslips, these in most instances correspond to notches in the edge of the crater from which they have slipped, and their debris has rolled onward over the plateau, towards the centre. The central cone was attributed to the last expiring efforts of the eruptive action.

Prof. Phillips observed that although there might be no sign of the existence of water on the present surface of the moon, he thought there were many indications of former aqueous action. There were elevations like the *escars* of Sweden and Ireland, and small gullies converging into larger, like the channels of mountain streams. He also called attention to the narrow, dark lines, many miles in length, occasioned by shadows which change with the direction of the sunlight, showing that the level is higher on one side than the other, as in cases of *fault*. Mr. Hopkins inquired into the evidence respecting the existence of an atmosphere, or of water, on the moon. If any atmosphere existed, it must be very rare in comparison with the terrestrial atmosphere, and inappreciable to the kind of observations by which it had been tested; yet the absence of any refraction of the light of stars during occultation was a very refined test. No equal means existed of ascertaining the presence of water on the moon; and if it did not now exist, the opinion of its former existence rested on very uncertain evidence. The large size of the lunar craters compared with any on the earth was accounted for if they were produced by the expansion of a fluid mass; for there was no reason why such a force should be materially less in the moon than the earth, whilst gravitation was much less. The result would be not only a much greater elevation, but less tendency to fall. He considered the annular craters were the remains of dome-shaped elevations, of which the central part had fallen in. The lunar craters were more numerous in proportion to the terrestrial; but there might have been many more on the earth which have been washed away. Mr. James Smith remarked that the perfection of the lunar volcanoes might be due to atmospheric conditions; and referred to the great circular crater of the Sandwich Islands as being terraced like Copernicus. Mr. Nasmyth expressed his very strong conviction of the total absence of water, or of traces of watery action, on the moon; and also of the absence of any atmosphere. The sudden disappearance of stars behind the moon, without any change or diminution of their brilliancy, was one of the most beautiful phenomena that could be witnessed.

On the Probable Former Existence of Palæozoic Glaciers: by Prof. Ramsay.

Admitting the probability that the earth had cooled down from a molten condition, the author contended that little trace of that refrigeration could be detected, as regards the climate of the globe, since the formation of the oldest fossiliferous strata. For a long time it had been supposed that the coal Flora indicated the influence of high internal temperature; the same inference was derived from the reptiles of the oolites and the nautili of the tertiaries. It had however lately been shown that the Silurian Fauna indicated a temperate climate in our latitude, and the other instances might be accounted for by a different geography. He then proceeded to show what he considered evidence of glacial action, during the latest Palæozoic period, in South Staffordshire and the Malvern district. This consisted in the occurrence of *trappean breccia*, sometimes more than 100 feet thick, amidst the marls and sandstones of the Permian series, or resting on the Silurian strata of Malvern and the Abberleys, where it had been described as trap by Sir R. Murchison. The base of the breccia is a fine soft red marl, like tertiary boulder-clay, containing angular masses of trap, of various sizes, up to two or three feet in diameter, seldom much water-worn, but having their surfaces more or less flattened and polished and scratched like stones from the moraines of Alpine glaciers. These blocks consist of greenstone, feldspars and feldspathic porphyries, altered slate-rocks, ribboned slates, green slates and sandstones, purple slates, and quartz rock, not derived from the underlying rocks, but brought from the Longmynd and Silurian Strata north of Bishop's Castle, some of them having travelled more than forty miles. The Longmynd is now only 1,900 feet above the sea; but on its eastern side, between it and the breccias, there is the great Church Stetton fault, a downthrow to the west of 3,500 feet. And although an elevation of even 6,000 feet would not give rise to glaciers on the Longmynd, Prof. Ramsay believed that in the Permian period they formed a mountain tract from which glaciers descended to the sea, and bergs broke off and floated away, as in the latest glacial seas. There are traces of this action being renewed twice,—the last being in the new Red Sandstone. Outlying fragments of Upper Silurian rest on the Longmynd, showing that it was originally covered, whilst the breccias prove that its denudation took place before the Permian period.

Sir C. Lyell admitted the failure of the old proofs that internal heat had controlled the climate within the historico-geologic period. The idea of glaciers in the Permian age was rather startling, and out of harmony with the fact that large Monitors existed in Thuringia, and tree-ferns flourished at the same period; but it was quite possible that the Permian period included temperate and torrid climates, just as both were found indicated in the tertiary. Prof. Phillips stated, that when he first examined this trappoid breccia at Malvern, where it exists at an elevation of 1,000 feet, he had been impressed with the conviction that it was very different, as to its origin, from the ordinary conglomerates of the new Red Sandstone, and even the notion of a glacial explanation had passed though his mind. Mr. Page declared himself a believer in the operation of glacial action from a period much earlier than the Permian; some of the conglomerates of the Old Red Sandstone were so like the accumulations of angular detritus carried by bergs and piled up on the shores of Polar Seas, that an Arctic voyager might suppose them formed in the same manner. Prof. Morris referred to the existence of a series of fossils, apparently indicating a warm climate in the strata immediately beneath the supposed glacial deposit, and to the recurrence of a similar series in the beds immediately above; and also to the existence of rock-salt and gypsum, supposed indications of a warm sea, in the New Red Sandstone. Prof. Forbes observed, that if the views of Prof. Ramsay were confirmed, they would throw great light on the changes of organic life at the close of the Permian period.

On the Thickness of the Ice of the Ancient Glaciers of North Wales, and other Points bearing on the Glaciation of the Country: by Prof. Ramsay.

Prof. Ramsay stated his belief that there had been two sets of glaciers in North Wales since the ground assumed its present general form. The first was on a very large scale, followed by a slow subsidence of the whole country to the extent of 2,300 feet, until only the tops of

the highest hills remained uncovered by the sea; and when the mountains again rose, a set of smaller glaciers was formed. The thickness of the ice in existing Swiss glaciers was known to be very great; in the Grindelwald it had been ascertained to amount to 700 feet, and in other instances was probably thicker. The observations of Agassiz and Prof. James Forbes on the height to which grooved and polished surfaces span up the sides of Alpine valleys, had led to the conclusion, that the ice had once been much more extensive; and that in the glacier of the Aar, for example, it must have amouuted to 2,000 feet. The same method of observation had been applied to North Wales, and it had been ascertained that iu the Pass of Llanberris the grooves and roundings of the rocks extended to a height of 1,300 feet above the bottom of the valley. The drifted deposits which overlie these rounded surfaces must have formed during the slow depression which followed, and the glaciers must still have existed, since these deposits, though marine, are still of a moraine character. The cold climate continued during the period of depression, aud for some time after it; and there was beautiful evidence in the side valleys of the gradual decrease of the glaciers until they died away amongst the higher mountains in the form of moraines stretching across the valleys, one within the other. The scratches made by the first set of glaciers passed down the valleys; those of the smaller glaciers crossed the first obliquely.

On the Anthracite Deposits, and the Vegetable Remains occurring in the Lower Silurians of the South of Scotland: by Prof. Harkness.

These strata form the high land south of the Firths of Forth and Clyde, and have a general inclination to the N.N.W. The highest beds are on the northern side of the range; and consist, near Girvan, of limestone and sandstone, with fossils of the Llandeilo rocks. To the southward fossils are rare; but near the lowest part of the series, at Glenkiln, nine miles from Dumfries, organic remains are found in beds of anthracite, resting on 1,500 feet of unfossiliferous purple and grey sandstones and shales. The fossils are *Graptolites saggitarius*, *Diplograpsus pristis* and *D. ramosus*: *Siphonotreta micula* occurs with the Graptolites in a thin bed of black shale at the base of the anthracitic beds. At Duff-Kinnel, crustaceans of the genus Dithyrocaris have beeu found. These fossils do not account for the carbonaceous matter in the black shales, but indications of "fucoids" have been found; and it is supposed that much of the hydrocarbon of these beds has been lost through the influence of mechanical forces. Fucoids of the genera Palæochorda and Chondites are found in the ripple-marked flags of a much higher part of the series, north of New Galloway, unaccompanied by anthracite, but associated with a zoophyte (*Proto-virgularia*) and tracks of Annelides. The Anthraeite beds were supposed to have derived their earbonaceous matter from sea-weeds floating like the gulf-weed of the present day.

Prof. Ramsay considered these black schists were of the age of the lower part of the Bala or Llandeilo series. Prof. Forbes remarked that the fossils usually called "fucoids" were rather to be regarded as zoophytes; aud the "Nereites" were believed by German palæontologists to be flexible bodies similar to Graptolites and not tracks of Annelides.

On the Sub-division of the Palæozoic Rocks of Scotland: by Mr. D. Page.

Passing by the oldest systems, the author proceeded to describe the typical developement of the Old Red Sandstone, remarking that the elassification of strata should always be founded on the district which exhibited their characters in the highest degree. The system was considered to extend downwards to the lowest stratum, containing remains of fishes, and to eonsist of three divisions:—1. The lowest, or Grey Sandstone series; 2. The Old Red Sandstone and eonglomerate, (*par excellence*); 3. The Yellow Sandstone series. The spinny-finned fishes (Cheiracanthus, &c.) were most abundant in the lower division; bony-cased fishes (Cephalaspis, Coccosteus' &c.) in the middle; and Holoptychii in the upper series. The "fucoids" were regarded as merely structural peculiarities of the rock; but according to Dr. Fleming, true plants also oceurred. The whole system was considered of marine origin, aud the eonglomerates were believed to have been transported from a great distance by the agency of ice, because the material is not sorted as it would be in a free flowing sea. The Carboniferous system represented the limestone, mill-stone grit, and eoal measures of England; but in the east of Seotland there was a peculiar set of sandstones below the carboniferous limestone, ealled the "caleiferous sandstone" by McLaren, and representing the earboniferous slate of Ireland. These lower eoal-measures included also the fresh water limestone of Burdie-house, and numerous beds of trappean ash; the sandstones were often ripple-marked, and apparently sub-aerial in their origin. The beds of coal were not workable, and were associated with peculiar fire-clay and shale; Araucariæ were more prevalent than tree-ferns, and Megalichthys and Palæoniscus the characteristic fishes. no shells occurred in the fire-clay, but only in the shales with the fish remains, indicating periodical inundations of the sea. 2. The carboniferous limestone was sometimes a very thin band, or several bands, at most amounting to 60 or 70 feet; the associated shales were fully developed, and the whole contained encrinites, reteporæ, minute trilobites, and other marine fossils, affording even when but a few feet thick an unerring guide to the miner. 3. The millstone grit was very thin, but in some places exactly like the grit of England. 4. True coal-measures, containing a greater variety of coal than in any other field —caking, free-burning, splint, and cannel coal of every variety, besides the "black band," which, if not "coal," passed insensibly into cannel, aud was so coaly as to have been interdicted from being worked; "mussel-bands" were of frequent occurrence; and there were indications of rapid formation and drift in the fish-scales and sea-shells. The Permian system was not represented in Scotland, unless the "flat coal" of the Fifeshire coast could be regarded in that light.

Dr. Griffiths remarked, that the term "yellow sandstone" had been already, and long ago, employed by himself for a lower division of the carboniferous system in Ireland; it was several thousand feet in thickness, and included shales, thin, unworkable coal, and limestone, with marine fossils, all characteristic of the carboniferous system.

On the Foliation of some Metamorphic Rocks in Scotland: by Professor E. Forbes.

It was of great importance to geologists to distinguish between lamination, cleavage, and foliation: the first resulted from original planes of deposition; the second was a superinduced structure, dividing rocks into laminæ of bedding; thirdly, foliation was the division of a rock into laminæ of different mineral condition. Cleavage had been attributed, by Prof. Sedgwick, its first definer, to electrical action; by Mr. Sorby, to a mechanical force; and by Mr. D. Sharpe, to mechanical and chemical influence. The foliation of mica slate, or separation of its mineral constituents into distinct layers, had been attributed to metamorphic action on layers of different constitution; Mr. Darwin had considered it identical with cleavage, and due to the same cause, —the one passing into the other: the same view has been maintained by Mr. Sharpe. Professor Forbes agreed with those who considered it a superinduced structure quite distinct from cleavage or lamination. The author then referred to examples of foliated structure. In a roadside quarry at Crianlarich, near the head of Loch Lomond, where the metamorphic limestone is not distorted, and exhibits distinct lines of bedding, of a pale blue colour, caused by the presence of iron; also lines of different mineral matter, the laminæ frequently curved round nuclei; and dark lines of erystals of calcareous spar produced, perhaps, by the metamorphism of bands and fossils. In the upper part of the quarry the limestone becomes foliated with mica,—the foliation being at first parallel with the bedding, then beeomes wavy and contorted, is affected by small faults, and contains nuclei of calcareous spar, and at length passes into a miea slate. At Ben Os there is a calciferous band in the mica slate, which, having the same strike with the Crianlarich beds, may eventually prove a guide in unravelling the structure of the country. Two miles from Inverarnon there is a bed of porphyritic trap in mica slate, and the foliation on the sides of the trap is eonformable. Four miles from Inverarnon, in a quarry of trap, which sends large and small veins into the mica slate, there is evidence of a second foliation having taken place, following the same veins of trap. Near Tarbert the mica slate is foliated and contorted; and a bed of calcareous grit cuts through it, without disturbing the relations of the curves and laminæ. In a slate quarry at Luss, the foliation accords in the main with the cleavage, as observed by Mr. Sharpe, in the eorresponding district; but whilst the foliation curves round the nuclei of quartz, the cleavage abuts against them. Foliation has also been noticed in the baked rocks of Salisbury Crags. Prof. Forbes concluded, 1, that foliation was a superinduced structure; 2, that it was distinct from cleavage; 3, that it was not of mechanical origin, but a chemical phenomenon; 4, that it was, perhaps, induced by more than one agency.

Sir C. Lyell remarked, that the Plutonie action, which had changed loose sand into quartz rock, shells into marble, and clay into feldspathic rocks, had often left the planes of stratifieation still visible. The unaltered sedimentary beds were frequently affected by irregularities as great as those of the altered rocks, and by erumplings which it seemed impossible to explain. If these were rendered metamorphic, there would be danger of attributing to chemieal action peculiarities which existed whilst the beds were yet unaltered.

INCORPORATED BY ROYAL CHARTER.

The attention of members of the Institute is requested to the subjoined extracts from the Regulations and By-Laws :—

1. The Sessions of the Institute shall commence annually on the first Saturday in December; and ordinary meetings shall be held on every succeeding Saturday (omitting the Christmas holidays), until the first Saturday in April; but it shall be in the power of the Council to protract the sessions if it should seem necessary. The chair may be taken when five members are present.

2. The chair shall be taken by the officer or member entitled to the same; and the business of the evening commence at eight o'clock precisely, and be conducted in the order prescribed in the By-Laws.

3. Every member shall have the privilege of introducing two visitors to be present at the public business of the Institute by ticket of admission, on which the name and address of each visitor must be written.

4. The annual general meeting of the Institute shall be held on the third Saturday in December, at seven o'clock in the evening, to receive and deliberate on the report of the Council on the state of the Institute, and to elect the officers and members of the Council for the ensuing year.

5. The Council may, at any time, call a special general meeting of the Institute for a specific purpose, giving to city members six days' notice; and they are at all times bound to do so, on the written requisition of five members, which shall specify the nature of the business to be transacted.

6. Those members of the Institute residing at a distance from the city, shall have the power of forming themselves into Branch Societies, for the purpose of holding meetings, and discussing scientific and other subjects; and are to be governed by the regulations of the Institute, and such other By-Laws hereafter to be enacted by them and approved by the Council.

BY-LAWS.

I. At the ordinary meetings of the Institute, every Saturday evening, the following order of business shall be attended to, as closely as circircumstances will admit:—

1. The Minutes of the previous meeting to be read and confirmed, and signed by the chairman; and no entry shall be considered valid until this be complete.
2. New members present to be introduced to the meeting.
3. Names of candidates for admission to be announced.
4. Business arising out of the Minutes to be entered on.
5. Communications received since the last meeting to be announced, and read if required.
6. Donations received and acknowledged.
7. Communications from the Council to be brought forward.
8. Candidates to be ballotted for. A ballot shall be taken for the entire body of candidates proposed for admission; if one or more black balls appear, the ballot shall be taken for each individually, and any candidate shall be rejected against whom appear a number of black balls equal to one-fourth of the number of members voting.
9. Papers on the lists to be read.

II. Notices of questions to be brought forward for discussion, must be given at least one week before the same shall be brought forward; and it shall be competent for the Council, or for any member to propose a subject for discussion.

III. A circular letter may be sent to all the country members, at the commencement of each session, with a list of questions that are appointed for discussion at the ordinary meetings of the Institute, requesting communications from the members on them, or on any other subject connected with the objects of the Institute.

IV. A similar letter may also be transmitted about the middle of the session, with the addition of any new questions that may have been brought forward and accepted; and at the end of the session, a list of questions shall also be sent to all the members, in order to collect information during the recess. Each letter shall contain a list of the written communications that have been made to the Institute.

COUNCIL MEETING,

THURSDAY, 9TH NOVEMBER, 1854.

DONATIONS.

Annales des Mines ou Recueil de Mémoires sur l'exploration des Mines et sur les sciences et les arts qui s'y rapportent; rédigees par les engénieurs des mines, et publiées sous l'autorisation du ministre des travaux publiques. 1st and 2nd livraison de 1854, presented by M. C. de Boilleau.

Journal of the Geographical Society, with Maps, Vol. 23.

General Index to the second ten volumes of the Journal of the Geographical Society.

Quarterly Journal of the Geological Society, Vol. IX., Part 1, 1853.

Trade and Navigation Reports for the Province of Canada, by the Hon. W. B. Robinson.

Various Parliamentary documents, by the Hon. W. B. Robinson.

Box of mineral specimens from Sault Ste. Marie, by Mr. A. McIntosh per Mr. S. Spreull.

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

INCORPORATED BY ROYAL CHARTER.

OFFICERS FOR 1854.

President:
G. B. FAIRBAULT.

Vice-Presidents—E. A. MEREDITH, L.L.B.; LIEUT. A. NOBLE, R.A.; LIEUT. E. D. ASHE, R.N., F.R.A.S.; G. T. KINGSTON.

Recording Secretary—HENRY E. STEELE.

Corresponding Secretary—LIEUT. H. G. SAVAGE, R.E.

Council Secretary—NOEL H. BOWEN.

Curator of Museum—ROBERT H. RUSSELL, M.D.

Curator of Apparatus—WILLIAM BONNING.

Treasurer—G. T. CARY.

Librarian—E. T. FLETCHER.

LITERARY OR STATED MEETING,
WEDNESDAY, 4TH OCTOBER.

The following donations were announced:—

An Oil Painting of the Steamship "Royal William," the first Steamship which crossed the Atlantic, from Captain McDougall.

A plan of Docks proposed to be erected on the beach of the River St. Charles, and approved of by the Earl of Dalhousie, from William Henderson.

Several curious Fossils and specimens of Natural History, from William Cooper, Toronto.

A paper was read by E. A. Meredith, L.L.B., on "the resources and capabilities of the Island of Anticosti," by A. R. Roche.

Henry E. Steele, of Quebec, was proposed as an Associate Member.

GENERAL MONTHLY MEETING,
WEDNESDAY, 11TH OCTOBER.

Mr. Roche's communication on "the resources and capabilities of the Island of Anticosti" was, on the Report of the Committee of Literature, ordered to be published in the transactions of the Society.

The following donations were announced:—

Specimens of Fossils from the Bermudas and other places, from John Fraser.

The following gentlemen were elected Associate Members:—

Captain A. T. Hamilton, 71st. Regiment; Lawrence Oliphant; A. R. Roche, and Henry E. Steele.

LITERARY OR STATED MEETING,
WEDNESDAY, 18TH OCTOBER.

An interesting paper was read by E. D. Ashe, Lieutenant, R.N. F.R.A.S., on "the Water Power of Quebec."

Literary and Historical Society of Quebec.

The Council of the Canadian Institute, at the request of the Council of the "Literary and Historical Society of Quebec," have authorized the publication in the *Canadian Journal* of a synopsis of the proceedings of the Quebec Society. As it is probable that the history and objects of this valuable Association are not generally familiar to our readers, we subjoin a brief account of its past progress and present condition.

The "Literary and Historical Society of Quebec," the oldest chartered Association of the kind in Canada, was founded in 1824, and owes its origin to the zeal and munificence of the Earl of Dalhousie, at that time Lieutenant Governor of Lower Canada. He is said to have suggested its formation, and in its early days, the Society was largely indebted to his fostering care. The preamble of the Charter of Incorporation states that the Society was formed "for the prosecution "of researches into the early history of Canada, for the recovering, "procuring and publishing of interesting documents and useful "information, as to the Natural, Civil, and Literary History of British "North America, and for the advancement of the Arts and Sciences in "the said Province of Lower Canada, from which public benefit may "be expected."

The inaugural address, and first Essay (on the juridical history of France) were read by Chief Justice Sewell, the first President, on the 31st May, 1824. This paper was followed by others of no common interest and ability, on the Geology of the country by Captain Bayfield, R. N. Captain Bonnycastle, R. E.; Lieut. Baddely, R. E.; and others. The Flora of Canada was investigated by the Hon. W. Sheppard, and W. Green, Esq., and papers on the Plants and Shells of the vicinity of Quebec, were transmitted to the Society by the Countess Dalhousie, and Mrs. Sheppard. Among the contributors to the department of Natural History and Climatology appear the Hon. J. Hale, Joseph Skey, M. D., and Wm. Kelly, M. D., Surgeon R.N.; W. Henry, Surg. 66th Regt., and H. D. Sewell, M. A. The History of the aborigines was largely discussed by Major Mercer, R. A., and others, and the late Rev. D. Wilkie, L. L. D.; Andrew Stuart, Esq., and Dr. Fisher, also appear among the list of contributors to the published transactions.

The amalgamation of this Institution with the "Society for the encouragement of Arts and Sciences," founded a few years later, took place in 1829. His Excellency, Sir James Kempt, who at that time became the patron of both Societies, suggested the advantage that must accrue by bringing together whatever talent and resources either possessed.

The progress of the Association has of necessity been considerably retarded by the calamity of the 2nd. February last, when the parliamentary buildings, part of which was occupied by the Society, were destroyed by fire. On this occasion all the furniture of the Society, nearly the whole of its Museum and apparatus, and great part of its Library were consumed; and it was only by the most strenuous efforts, that the valuable "Records of the Realm," in eighty or ninety folios, and the unique collection of Historical manuscripts, procured at an expense of many hundred pounds, were saved from destruction.

Paralysed by this severe blow, uncheered by sympathy from those around, without a shadow of assistance from the authorities, and compelled for the time to fall back on the individual exertions of its members, the Society deemed it proper, in the interests of science, to submit its condition to other American Institutions of a similar character. A petition has also been laid before the Legislature, and strong hopes are entertained that its affairs, ere long, will assume a more favourable aspect, and its effectiveness and utility be completely restored.

It is a gratifying fact, however, and one which reflects great credit upon the officers of the Society, and on its members generally, that notwithstanding the severe ordeal through which the Society has lately passed, it evinces at the present moment greater activity and zeal, and numbers more members, than it has done for many years before.

It may be as well to mention, in reference to the proposed publication of the proceedings of the Society in the "Canadian Journal," that under the Charter "General Meetings" of the Society are held on the second Wednesday of every month, for the transaction of the business of the Society, and that under the By-Laws of the Society, Literary, or Stated meetings are held on the first and third Wednesday of every month from October to April, both inclusive.

Meteorology of Quebec.

We are again indebted to Lieut. A. Noble, now assisted by Mr. W. Campbell, for the Monthly Meteorological Table for Quebec, which appears in the present issue of the *Canadian Journal.*

While thankfully acknowledging the resumption of the Quebec observations, we cannot but express great regret that uncontrolable events should have prevented their continuance during the past remarkable summer. Nearly simultaneous observations during that interesting period at Quebec, Montreal and Toronto, would have possessed no ordinary interest or value.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—October, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg.				Temp. of the Air.				Mean Temp. + or — of the Average	Tension of Vapour.				Humidity of Air.				Wind.				Rain in Inch.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.		6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	M'N.	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	
					°	°	°	°	°													
1	29·523	29.285	—	—	53·2	61·4	—	—	—	0·365	0·486	—	—	·91	.91	—	—	Calm	S W b S	—	5·74	0·145
2	·535	·466	29·394	29·453	39.5	63·5	49·5	51·55	+ 1·62	·208	·241	0·251	0·251	87	42	·72	·69	Calm	S S W	Calm	3·02	...
3	·119	28·756	28·795	28·885	49·2	63·5	52·8	55·77	+ 6·23	·270	·424	·344	·365	78	75	87	83	E N E	E S E	S W b W	8·01	0·465
4	28·949	29·288	29·599	29·313	46·0	56·3	40·9	47·35	— 1·68	·256	·231	·192	·224	83	52	75	70	S W b W	N W b W	N W b W	11·12	...
5	29 818	·886	·841	·856	31·6	56·4	45·2	45·33	— 3·28	·168	·233	·252	·229	95	53	85	78	Calm	W	Calm	2 98	...
6	·886	·813	·816	·837	41·7	63·7	51·7	54·05	+ 5·83	·166	·318	·316	·285	63	55	84	69	Calm	S W b S	S W b W	4·44	...
7	·841	·818	·863	·840	50·3	74·2	60·1	61.48	+13·63	·305	·470	·450	·404	85	57	88	77	S W b W	S W	N W	2·00	0·005
8	·835	·722	—	—	57·2	68·4	—	—	—	·397	·462	—	—	87	68·	—	—	Calm	E b S	—	2·02	...
9	·633	·567	·669	·629	50·4	70·7	54·9	57·18	+10·12	·303	·458	·364	·370	84	63	86	80	Calm	W S W	N b E	3·27	0·035
10	·781	·775	·702	·748	50·6	47·0	51·3	50·05	+ 3·38	·330	·286	·340	·309	91	90	91	87	E N E	E N E	E b N	5·79	0·275
11	·626	·548	.493	·549	47·6	68·2	53·0	56·82	+10·57	.306	·486	·367	·387	94	72	93	85	Calm	S S W	Calm	2·35	0·110
12	·447	·435	·627	·524	55·6	64·0	50·8	56·10	+10·13	·403	·496	·298	·387	93	86	81	86	Calm	S W	N N W	4·82	0·015
13	·740	·740	·670	·715	43·1	49·2	44·9	46·07	+ 0·50	·232	·274	·252	·250	84	79	85	81	N	E	Calm	3·50	0·205
14	·387	·295	·465	·385	48·8	53·8	37·7	45·97	+ 0·70	·330	·235	·179	·239	97	58	80	77	E	N W	N N W	13·41	...
15	·519	·461	—	—	36·6	45·7	—	—	—	·155	·130	—	—	72	43	—	—	N W b N	N W b N	—	10·77	...
16	·277	·259	·415	·324	36·6	50·6	42 8	43·05	— 1·48	·192	·261	·238	·230	89	72	88	84	W N W	W N W	N b W	7·47	0·010
17	·561	·597	·602	·580	35·9	49·2	39·0	40·75	— 3·48	·180	·225	·207	·212	86	65	88	84	N W b N	S S W	N W b W	3·52	...
18	·596	·731	·873	·743	34·1	41·6	33·0	36·60	— 7·43	.162	·115	·155	·149	82	44	82	70	W b N	N W b N	N W b N	9·43	...
19	30·012	30·042	30 017	30·034	29·8	45·2	33·4	35·78	— 8·00	·136	·179	·166	·158	82	60	87	76	Calm	S b W	Calm	2·32	...
20	30·023	30·017	30·006	30·019	36·8	49·9	44·9	43·85	+ 0·28	·173	·237	·226	·211	79	67	76	74	Calm	S S E	Calm	1·85	...
21	30·010	29·993	29·972	29·995	37·0	53·6	42·0	44·50	+ 1·25	·182	·194	·204	·202	83	48	77	71	N b E	S b E	N b E	2·40	...
22	29·943	·924	—	—	46·3	51·5	—	—	—	·249	·290	—	—	80	78	—	—	N N E	E N E	—	6·64	0·055
23	·899	·867	·890	·890	49·2	53·6	52·2	51·40	+ 8·65	·260	·322	·294	·292	76	80	77	78	E b N	E	E b N	4·12	...
24	·941	·953	30·016	·975	48·8	60·8	48·8	52·77	+10·27	·292	·376	·283	·314	86	72	83	80	E b N	S	Calm	0·81	...
25	30·102	30·085	30·072	30·087	50·5	59·7	49·2	53·32	+11·03	·281	·398	·269	·328	78	80	78	81	N b W	S	Calm	0·77	...
26	30·097	30·037	29·988	30·036	41·3	61·1	43·7	48·72	+ 6·73	·211	·388	·262	·287	82	74	93	84	Calm	S S E	Calm	1·74	...
27	29·983	29·944	·906	29·942	44·3	55·3	41·5	46·22	+ 4·43	·262	·375	·240	·289	91	88	93	92	Calm	Calm	Calm	0·43	0·040
28	·873	·830	·809	·839	42·4	59·8	50·3	50·90	+ 9·42	·252	·383	·341	·327	94	76	95	89	Calm	E S E	N E b N	2·17	0·015
29	·729	·645	—	—	56·0	57·4	—	—	—	·379	·415	—	—	86	90	—	—	N E b E	N E b E	—	2·39	0·050
30	·655	·592	·498	·574	53·8	62·5	59·1	58·62	+17·67	·363	·388	·426	·401	89	70	87	84	Calm	E b S	E b N	3·58	0·035
31	·374	·278	·278	·311	57·8	58·5	46·4	53·42	+12·67	·442	·398	·282	·371	95	83	90	92	Calm	S S W	W	9·86	0·035
M	29·699	29.677	29·703	29·6955	44·33	57·38	46·89	49·52	+ 4·48	0·256	0·323	0·277	0·287	87	68	85	80	3·13	7·14	3·76	4·60	1·495

Highest Barometer...... 30·121, at 8 a.m. on 26th } Monthly range:
Lowest Barometer....... 28·731, at 3 p.m. on 3rd } 1·390 inches.
Highest registered temperature 75°·4, at p.m. on 7th } Monthly range:
Lowest registered temperature 26°·4, at a.m. on 19th } 49°·0.
Mean Maximum Thermometer.............. 58°·97 } Mean daily range:
Mean Minimum Thermometer.............. 41°·32 } 17°·65.
Greatest daily range.........27°·4, from p.m. of 4th to a.m. of 5th.
Warmest day........ 7th. Mean temperature...... 61°·48 } Difference,
Coldest day......... 19th. Mean temperature...... 35°·78 } 25°·70.
Greatest intensity of Solar Radiation, 84°·6 on 9th, p.m. } Range,
Lowest point of Terrestrial Radiation, 22°·4 on 19th, a.m. } 62°·2.
Aurora observed on 5 nights: viz. 2nd, 12th, 17th, 18th and 23rd.
Possible to see Aurora on 20 nights.
Impossible to see Aurora on 11 nights.
Raining on 15 days. Raining 45·3 hours: depth, 1·495 inches.
Particles of Snow fell on 16th, 17th and 18th—quantity inappreciable.
First Snow of the Season observed on the 16th.
No Thunder Storms recorded this month.
Sheet Lightning occurred on the 10th, 17th and 24th.

The weather during the week ending 28th was mild and pleasant, and partook in some measure of the character of Indian Summer.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1446·18	1409·73	636·20	1781·99

Mean direction of the Wind, N 25° E.
Mean velocity of the Wind, 4·60 miles per hour.
Maximum velocity, 26·1 miles per hour, from 9 to 10 a. m. on 4th.
Most windy day, the 14th; mean velocity, 13·41 miles per hour.
Least windy day, the 27th; mean velocity, 0·43 " "

During the gale on Saturday the 14th, the velocity of the wind from 3 to 4 p.m. was 25·5 miles, and the mean velocity from noon to 6 p.m. equalled 22·17 miles per hour.

2nd, 10·17 p.m. A large Meteor appeared about 25° S. of zenith, and passing due W. burst in its flight, throwing out a great number of sparks, and left a train of light behind it.

24th, 8·26 p.m. Very large mass of nebulous light (undefined meteor,) appeared near γ Draconis, and, passing between γ & β Urs. Maj., emitted a very strong light and disappeared behind a mass of clouds on N. horizon.

October, 1854, was the warmest on the records of the Observatory; and has been remarkable for sudden changes of temperature; the mean temperature of the 19th was 8° colder than the mean normal temperature of that day, and that of the 30th was 17° 7 warmer than its mean normal temperature. The amount of Rain was small, being the least but two (October, 1841, and 1853) on the list for the last 15 years; it was, in short, a warm, dry month.

Comparative Table for October.

Year.	Temperature.					Rain.		Snow.		Wind. Mean Velocity.	
	Mean.	Dif. from Av'ge.	Max. obs'vd	Min. obs'vd	Range	D's.	Inch.	D's.	Inch.		
	°	°	°	°	°						
1840	44·4	—0·8	68·5	23·9	44·6	13	1·860	3	...	...	
1841	41·6	—3·6	58·3	20·3	38·0	6	1·360	2	...	0·41	lb.
1842	45·1	—0·1	68·5	30·0	38·5	8	5·175	0	...	0·35	lb.
1843	41·8	—3·4	65·7	24·5	41·2	12	3·790	4	2·5	0·54	lb.
1844	43·3	—1 9	69·6	17·8	51·8	7	Impf	4	12·0	0·43	lb.
1845	46·4	+1·2	62·7	20·0	42·7	11	1·760	1	Inap.	0·26	lb.
1846	44·6	—0·6	69·7	20·7	49·0	14	4·180	2	Inap.	0·44	lb.
1847	44·0	—1·2	65·0	20·3	44·7	13	4 390	2	Inap.	0·19	lb.
1848	46·3	+1·1	62·2	26·4	35·8	11	1·550	0	None	4·60	Miles.
1849	45·3	+0·1	59·2	25·5	33·7	13	5·965	1	Inap.	4·76	Miles.
1850	45·4	+0·2	66·6	24·8	41·8	10	2·085	0	None	5·30	Miles.
1851	47·4	+2·2	66·1	25·0	41·1	10	1·680	2	0·3	4·39	Miles.
1852	48·0	+2·8	70·7	29·8	40·9	12	5·280	0	None	4·47	Miles.
1853	44·4	—0·8	64·7	25·5	39·2	10	0·875	2	Inap.	4·72	Miles.
1854	49·5	+4·3	74·2	29·8	44·4	15	1.495	3	Inap.	4·60	Miles.
										0·37	lbs.
M'n.	45·17		66·11	24·29	41·83	11·0	2·960	1·7	1·2	4·69	Miles.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	Inch.	6 A.M.	2 P.M.	10 P.M.
1	29·803	9·346	29·417	46·5	53·0	50·2	·262	·361	·379	·80	·87	·99	S S W	S W	S W b S	0·02	2·50	1·50	0.116	Cum. Str. 10.	Slight Rain.	Rain.
2	·603	·679	·705	44·6	60·6	49·4	261	330	290	85	63	80	W b N	W b N	W b S	18·30	16·28	0·95	0 0 0	Clear.	Cum. Str. 4.	Clear.
3	·620	·246	·209	45·0	59·0	54·2	292	478	373	93	94	87	W b S	S W b S	S E b S	6·75	6·62	14·51	0.433	Do.	Rain.	Cir. Str. 9.
4	·300	·390	·678	51·6	58·0	45·1	337	437	253	87	89	80	S S W	N W	N N W	12·50	17·48	12·51	0·400	Cir. C. Str. 8.	Cum. Str. 8.	Do. do. 8.
5	·989	30·123	30·165	40·6	47·6	36·7	210	252	192	83	74	83	N b W	N b W	N b W	11·43	1·57	3·65	...	Clear.	Do. 4.	Clear.
6	30·122	30·114	30·130	40·7	64·8	54·1	245	425	326	92	71	76	S W	S S W	S S W	0·27	1·04	1·51	...	Do.	Do. 4.	Do.
7	30·074	29·916	30·106	49·0	75·0	65·0	336	428	499	93	50	80	S S W	W b S	W b S	17·62	7·70	1·75	...	Do.	Do. 2.	Cum. Str. 4.
8	30·196	30·146	30·118	48·8	53·1	48·7	242	293	242	71	70	72	N E	E N E	N E b E	5·55	4·38	1·17	...	Str. 10.	Do. 8.	Do. 7.
9	29·979	29·816	29·896	41·8	47·6	44·0	253	291	282	92	86	92	N N E	W N W	W b N	3·55	0·62	2·28	0.874	Rain.	Do. 9.	Do. 6.
10	30·104	30·106	30·117	35·6	67·2	39·7	203	506	214	91	76	84	N W	W S W	W S W	0·95	0·37	0·17	...	Clear.	Clear.	Clear.
11	29·930	29·729	29·842	34·8	68·9	63·3	208	541	461	93	73	79	W S W	W S·W	W S W	0·05	4·84	3·73	...	Do.	C. Cum. Str. 4.	Str. 10.
12	·788	·724	·742	60·1	66·4	60·1	494	516	494	94	80	94	W S W	W S W	W S W	3·43	8·88	0·70	0·116	Cir. Str.	Showers.	Cum. Str. 8.
13	·870	30·017	30·084	38·6	49·6	37·4	189	233	218	76	64	91	N N E	E b N	E b N	12.49	2·20	0·42	...	Clear.	Cum. 4.	Clear.
14	·862	29·435	29·476	33·0	42·3	43·9	207	284	300	1·00	99	98	E N E	E b N	W	0·11	4·66	5·02	1.073	Fog.	Rain.	Rain.
15	·498	·446	·496	38·0	45·0	40·9	209	241	210	85	76	79	W b N	N W b N	W N W	15·52	9·14	10·66	0·100	Cum. Str. 10.	Rain.	Cir. Str. 10.
16	·379	·480	·600	33·1	42·0	37·7	187	189	199	90	66	83	W	W N W	W b S	20·00	17·98	6·80	...	Do. do. 2.	Clear.	Do. 9.
17	·795	·869	·898	34·0	42·1	36·0	195	179	199	92	65	85	N W	W b N	N	2·77	0·88	Inap.	...	Do. do. 4.	Cir. Cum. Str. 8.	Do. 4.
18	·901	·703	·966	29·5	46·9	36·1	166	194	199	90	89	85	W S W	N E	N E b E	Inap.	0·83	0·81	...	Clear.	Do. 8.	Do. 2. Aur. Bor.
19	30·200	30·242	30·280	31·0	42·0	32·0	178	198	·191	92	70	95	W b S	W b S	W b S	0·03	5·88	8·43	...	Do.	Clear.	Clear.
20	30·371	30·351	30·346	25·0	44·2	41·3	148	241	235	96	80	85	W b S	S S E	S W b S	0·44	0·22	0·39	...	Do.	Cum. Str. 8.	Slight Rain.
21	30·359	30·330	30·332	39·1	54·0	38·0	242	285	207	94	69	84	S b W	S S W	S S W	1·23	0·10	0·62	0.233	Cum. Str. 4.	Clear.	Clear.
22	30·296	30·265	30·299	27·8	60·6	40·0	167	467	227	1·00	89	85	S b W	S W b W	W S W	Calm	Calm	Calm	...	Clear.	Do.	Do.
23	30·381	30·316	30·313	37·0	52·2	43·7	199	283	233	83	70	79	N E b E	N E b E	N E b N	4·68	7·93	4·47	...	Cum. Str. 4.	Do.	Str. 10.
24	30·289	30·219	30·252	36·3	60.3	52·0	210	330	315	91	63	81	N E b N	S W b W	W	3·39	0·22	Inap.	...	Str. 2.	Cir. Cum. Str. 4	Do. 9.
25	30·340	30·220	30·310	49·7	66·1	46 6	312	384	282	86	60	86	N W	W b N	E b N	0·27	1·50	1·13	...	Do. 8.	Clear.	Clear, Aur. Bor.
26	30·321	30·271	30·277	46·2	57·8	49·0	303	376	320	93	79	87	W S W	W S W	W S W	1·33	1·11	2·33	...	Clear.	Cum. Str. 10.	Do.
27	30·268	30·241	30·230	44·0	60·6	51·0	282	393	351	92	75	89	S W	S W	S W b S	1·00	Calm	1·51	...	Do.	Clear.	Do.
28	30·244	30·178	30·140	41·1	71·0	54·1	273	542	373	99	71	87	W b N	W S W	N E b E	Inap.	Calm	0·20	...	Fog.	Cum. Str. 9.	Str. 10.
29	30·118	30·031	30·005	40·0	60·5	54·7	260	441	440	98	84	99	N E b E	N E b N	N E	0·23	0·60	1·50	0.306	Str. 8.	Str. 6.	Do. 8.
30	29·982	29·952	29·944	54·0	73·6	61·9	416	515	528	96	64	94	E N E	E N E	N E b E	0·22	0·70	1·16	...	Do. 6.	Do. 8.	Do. 8.
31	·937	·561	·468	58·0	67·3	57·6	498	626	422	1·00	94	89	E N E	S S E	S W b W	5·00	2·81	7·50	1.14[illegible]	Rain.	Cir. Cum. Str. 5	Do. 2.

Barometer	Highest, the 20th day	30·371
	Lowest, the 3rd day	29·209
	Monthly Mean	29·949
	" Range	1·162
Thermometer.	Highest, the 30th day	79°·7
	Lowest, the 20th day	24°·2
	Monthly Mean	48°·40
	" Range	55°·5
	Mean Humidity	·874
Greatest Intensity of the Sun's Rays		118°·4

Amount of Evaporation, 1·49 inches.
Rain fell on 11 days, amounting to 4·844 inches. Raining 33 hours, 55 minutes.
First Snow fell on 15th day, 3·10 inches.
Most prevalent Wind, W.S.W. Least prevalent Wind, N.
Most Windy Day, the 16th day; mean miles per hour, 14·92.
Least Windy Day, the 22nd day; mean miles per hour, 0.
Aurora Borealis visible on 2 nights. Might have been seen on 12 nights.
Electrical Apparatus put in order on the 7th day; since which time the Electrical State of the Atmosphere has been marked by moderate intensity.

Monthly Meteorological Register, Quebec, Canada East, October, 1854.

BY LIEUT. A. NOBLE, R.A., AND MR. W. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Miles. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	29·821	29·542	29·264	29·542	40·9	48.1	47·9	45·6	0·184	0·268	0·326	0·259	73	80	99	84	S W	S W	Calm.	3·8	3·8	0·0	1.00	...	
2	·262	·430	·470	·387	45·4	55·8	47·8	49·7	·230	·147	·210	·196	77	30	64	57	W	W	W	6·2	10·1	8·0	...	...	2nd. Faint Auroral Light, visible at 11, p.m.
3	·489	·426	·217	·377	41·0	60·3	50·1	50·5	·204	·245	·334	·261	80	48	94	74	Calm.	S W	S W	0·0	11·3	12·4	1·12	...	
4	·113	·200	·320	·211	52·0	57·4	47·0	52·2	·359	·380	·271	·337	94	83	85	87	S	S b W	S b W	7·2	11·3	12·4	·11	...	
5	·587	·760	·921	·756	39·3	45·2	36·5	40·3	·178	·151	·151	·160	75	51	71	66	W	W N W	N W	7·2	15·2	8·0	...	...	
6	·921	·845	·848	·871	35·8	59·0	51·5	48·8	·188	·266	·281	·245	90	54	75	73	Calm.	W	W	0·0	6·2	3·8	...	...	6th. Lunar Halo, 30°. in diameter, visible at 10, p.m.
7	·833	·730	·834	·799	47·8	63·5	58·4	56·7	·278	·337	·332	·316	85	59	69	71	Calm.	W	Calm.	0·0	7·2	0·0	...	...	
8	·967	·924	·890	·927	44·5	54·3	48·0	48·9	·175	·172	·225	·191	60	41	68	56	N W	E b N	E b N	2·0	3·8	2·0	·01	...	
9	·797	·609	·577	·661	42·4	45·1	44·0	43·8	·198	·228	·236	·221	74	76	83	78	N E	N E	N E	13·4	10·1	10·1	...	...	
10	·784	·812	·895	·830	43·5	52·5	42·0	46·0	·138	·160	·173	·157	49	42	66	52	N E	S	S	12·4	10·1	2·0	...	...	
11	·785	·566	·541	·631	35·6	53·0	52·4	47·0	·159	·308	·360	·276	76	79	94	80	Calm.	W	Calm.	0·0	8·0	0·0	·50	...	11th. Hoar Frost, 6, a.m.
12	·549	·487	·513	·516	52·1	45·6	41·4	46·4	·383	·284	·239	·302	100	94	93	96	S E	N E	N E	3·8	20·2	16·0	1·10	...	12th. Higher stratum of cl'ds moving from West. Lower stratum moving with the wind.
13	·783	·889	·850	·841	40·4	42·5	38·6	40·5	·256	·162	·204	·207	91	60	87	79	S W	N E	S W	3·8	11·3	13·4	·01	...	
14	·714	·528	·309	·517	39·3	44·5	43·6	42·5	·223	·250	·260	·244	94	86	93	91	E N E	E N E	E N E	10·1	11·3	12·4	·64	...	
15	·248	·205	·118	·190	41·0	41·8	41·5	41·4	·231	·236	·228	·232	91	90	88	90	E N E	E N E	E N E	13·9	16·9	3·8	·37	...	
16	28·982	28·972	·305	·086	40·7	38·5	36·5	38·5	·246	·205	·192	·214	98	88	89	92	W S W	W S W	W	8·0	10·1	10·1	·09	Inap	16th. Snowed during 2 hours.
17	29·462	29·522	·635	·540	35·2	41·0	38·0	38·1	·160	·181	·206	·182	79	71	91	80	W	Calm.	W	6·2	0·0	7·2	...	...	
18	·742	·634	·725	·700	38·5	42·6	35·9	39·0	·178	·177	·135	·163	77	66	65	79	Calm.	S W	W N W	0·0	2·0	2·0	...	...	18th. A fine display of Aur.
19	·832	·912	30·008	·917	32·5	43·5	35·8	37·3	·128	·160	·193	·160	70	57	92	73	N W	W	W	10·1	10·1	10·2	...	Inap	19th. Snowing 2.5 hours.
20	30·066	30·107	30·096	30·090	32·4	40·8	39·3	37·5	·164	·181	·179	·175	90	72	74	79	W	W	Calm.	6·2	8·0	0·0	·04	...	
21	30·092	30·115	30·100	30·102	39·2	44·3	42·7	42·1	·226	·234	·232	·231	95	81	86	87	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...	
22	30·072	30·012	30·101	30·062	39·9	52·4	42·3	45·0	·218	·238	·196	·217	89	62	74	75	S W	S S W	W	2·0	3·8	3.8	...	...	
23	30·195	30·183	30·169	30·182	36·2	41·4	40·0	39·2	·169	·145	·168	·161	94	56	69	73	N E	E	E	12·4	10·0	10·0	...	...	
24	30·109	30·030	30·020	30·053	40·3	50·4	48·6	46·4	·199	·189	·212	·200	81	52	63	65	Calm.	Calm.	Calm.	0 0	0·0	0·0	...	...	
25	30·073	30·110	30·107	30·097	46·6	55·1	47·1	49·6	·252	·270	·243	·255	80	64	76	73	Calm.	S W	Calm.	0·0	2·0	0·0	...	...	25th. A well defined Auroral arch visible at 8, p.m.
26	30·143	30·049	29·994	30·062	42·4	49·1	50·2	47·2	·218	·278	·293	·263	82	81	81	81	N E	S S E	S S E	3·8	3·8	5·2	...	...	
27	30·050	30·012	30·000	30.021	45·6	53·6	51·3	50·2	·288	·233	·340	·287	95	33	91	76	N W	S	Calm.	6·2	3·8	0·0	...	...	
28	30·033	30·003	29·974	30·003	45·8	62·3	52·6	53·6	·304	·414	·303	·340	100	76	78	85	W S W	W S W	W	8·0	6·2	2·0	...	...	
29	29·934	29·876	·805	29·872	47·0	64·2	55·6	55·6	·264	·391	·398	·351	83	67	92	81	Calm.	W S W	Calm.	0·0	2·0	0·0	·75	...	
30	·805	818	·813	·812	56·1	55·6	54·3	55·3	·428	·427	·393	·416	97	99	95	97	Calm.	N E	N E	0·0	3·8	11·5	·44	...	
31	·687	·482	·253	·474	47·9	51·7	58·6	52·7	·329	·352	·470	·384	100	94	97	97	N E	Calm.	S W	11·3	0·0	12·4	·80	...	
	29·772	29·735	29·731	29·746	42·17	50·16	45·79	46·05	0·231	0·247	0·258	0·245	84	68	82	78				5·10	7·21	5·76	6·98	Inap	

Maximum Barometer, 6 a.m. of 23rd	30·195
Minimum Barometer. 2 p.m. of 16th	28·972
Monthly Range	1·223
Monthly Mean	29·746
Maximum Thermometer on the 7th	64°.7
Minimum Thermometer on the 18th	31°·6
Monthly Range	33·1
Mean Maximum Thermometer	51·6
Mean Minimum Thermometer	39·1
Mean Daily Range	12·5
Mean Monthly Temperature	46·05

Greatest Daily Range of Thermometer on 6th	23°·1
Least Daily Range of Thermomter on 15th	2°·0
Warmest Day, 7th. Mean Temperature	56·7
Coldest Day, 19th. Mean Temperature	37·3
Climatic Difference	19·4

Possible to see Aurora on 9 Nights.
Aurora visible on 8 Nights.
Total quantity of Rain, 6·98 inches.
Total quantity of Snow, inap.
Rain fell on 14 days.
Snow fell on 2 days.

The Canadian Journal.

TORONTO, JANUARY, 1855.

Lighthouse on the New South Shoal, Nantucket, U. S. *

THE SCREW PILE—THE PNEUMATIC PILE.

No work of a solid character placed on a submerged sand at so exposed a point as New South Shoal, were it possible to found one, could long withstand the power of the ocean. That it would not be overthrown by the direct blow of the waves, the successful resistance of the works just named (Eddystone, Bell Rock, Skerryvore Lighthouses), at points where the inclination of the bottom and the depth of water are calculated to give greater force to the waves, prove beyond all reasonable doubt; but that its destruction would nevertheless be inevitable, from the rapid and ceaseless process of the wasting of the sands of the shoal, caused by the recoil of the sea, from the mass, is no less certain. To provide a base of sufficient size and strength to sustain the necessary superstructure, that shall at the same time offer no very sensible obstruction to the free passage of the currents and the waves, is the great desideratum in founding works on submerged soils exposed to the batter of the ocean. This desideratum the last few years has supplied in the screw-pile of Mr. Alexander Mitchell, of Belfast, and in the pneumatic pile of the late Dr. Lawrence Holker Potts, of London. The next inquiry in order is, whether either of these modes is applicable to the site of New South Shoal. After much reflection, aided in no small degree by the experience acquired in the erection of the light-house on the Brandywine, I am of opinion that the first, being the method of screw-piles, cannot be employed to found a work at that point: and for these reasons:

1. That the screws could not be made to penetrate the shoal to the required depth, by any means applied from a *floating* body, moored in the tide and sea-way at the point in question.

2. That it is not possible to erect a temporary fixed structure during the working season at so exposed a point, at least in time to be available for driving the screw-piles; and,

3. That if it were possible to raise such a structure in time, it is doubted whether any power applied from it could insert the piles to a necessary depth, into a sand so hard and compact.

The screw-pile has been successfully applied in forming foundations of light-houses on the Maplin Sands, mouth of the Thames; on the North Wharf Sands, mouth of the Wyre; on the shoal ground of Holywood, Belfast bay; and, in this country, on Brandywine shoal, mouth of Delaware bay. The attempt to erect a light house on the north end of the Kish Bank, in St. George's channel, by means of these piles, failed, from no defect in the principle claimed for these useful appliances in forming submarine foundations, but principally, as it is understood, from the coming up of a heavy gale from the south-east before the piles were properly braced and the diagonal stays attached. The design to raise a beacon of screw-piles on the eastern end of the Tongue Bank also proved abortive; but, as the case of the structure on the Kish Bank, from no inherent defect in the piles themselves. This beacon was composed of five six-inch piles, and raised in position by the Trinity House. Shortly after it was put up, it was discovered that an accident had happened to it, and, on examination, it was ascertained that three of the piles were broken off short, and the other two bent. The stump of the broken piles, and the lower parts of the bent piles, were found perfectly upright, and the sand around them undisturbed; showing the structure failed from no fault of the *hold* they had taken of the ground. Their condition indeed affords the best evidence of the capacity of the screw pile on this point, as it appears the force that was sufficient to break off three and bend two wrought-iron piles of the size stated, was, at the same time unequal to the task either of uprooting them or even changing their position in the bottom. As the force of the waves, acting on such small surfaces as these piles presented, was entirely inadequate to produce the effects described, the destruction of the beacon was sought for in other causes. The conclusion arrived at, at the time, and no doubt the correct one, was, that a vessel had passed over it; a conclusion in a measure confirmed by finding the copper of a vessel attached to the top of one of the bent piles. It may be remarked here, incidentally, that accidents from this cause form the only real objection, save the destructible character of the material, either to the screw-pile or the pneumatic-pile, and only then of works founded in navigable depths.

The pneumatic-pile of Dr. Potts is of more recent origin than the screw-pile, or, at least has not been so long known to the public. It has not yet, it is believed, been successfully applied in founding works, such as light-houses, beacons, harbours, &c., exposed to the sweep of the ocean. That it is practically applicable for the purpose there is every reason to believe. The favourable opinion of those well known in engineering and construction in Great Britain, communicated in the report on the ice-harbours of the Delaware, dated the 28th December last, may be received as conclusive, particularly as it is supported by cases of application already made in other, and in some respects kindred works, on this point. To this testimony and to these cases the bureau is again referred for all the information in possession of this office upon the subject. Of the latter it is deemed sufficient for the present occasion to recount merely the following instances in which these piles have been used, to show that their size, both length and diameter considered, would seem only limited in their application to the power under the circumstances to handle them. Besides being employed, among other instances, in the founding of the piers of a viaduct in Anglesey over an arm of the sea, the bed of which is of running sand and gravel of great depth; in an experiment on Grain Spit to test the powers of the piles to sustain great weights; in the sinking of a pile of large dimensions in a quicksand in Cornwall; in the construction of a bridge over the Thames at Datchet; and in the foundation of part of a large viaduct on the Holyhead line of railway, a pile of this description, 3 feet in diameter, has been sunk in the Goodwin Sands to the depth of 77 feet, to the chalk formation; and others of the enormous size of 10 feet diameter as cofferdams, in the construction of the Midland Great Western Railway bridge over the Shannon. To this list may be added the new bridge over the Thames from Putney to Fulham, in which the piers will be formed of four cast-iron cylinders 8 feet in diameter, carried to such a depth as not to interfere with the dredging of the river. It is proper to remark here, that other applications of both the screw-pile and pneumatic-pile either in constructions or in experiments, may have been made and noticed in the publications of the day, par-

* Abstract of a report to the Senate of the U. S. communicating, in compliance with a resolution of the Senate, a Report &c. from Major Hartman Bache, in reference to the construction of a Lighthouse or Beacon on the New South Shoal of Nantucket.

ticularly in periodicals devoted to such and kindred subjects; but as these, in consequence of the restrictions upon the purchase of books, are only occasionally accessable, and then through private sources, nothing is positively known as to the fact.

The objection to screw-piles for founding a work at New South Shoal does not apply—except as to giving them their true relative position—to pneumatic piles, which, being sunk into the bottom by atmospheric pressure caused by exhausting the air from the hollow shaft, the erection of a fixed structure, such as that required to apply the mechanical power to drive the former, is dispensed with, and the objection to the great length of the pile through which this power must be exerted, at the same time got rid of. But it must not be supposed, that because a fixed structure is not indispensable, a floating body is deemed sufficient for the successful application of atmospheric piles in the present instance. This is not the case. That these piles may be planted singly in favourable weather at so exposed a point as New South Shoal, by well-devised measures fully matured, from so unstable a footing as a floating body, the sinking of the cylinder on the Goodwin Sands is of itself abundantly sufficient to prove; but that the number of piles required to constitute a foundation for a light-house or beacon may, under the circumstances, be made to receive their proper relative positions, so far at least, as to render them properly available for the intended purpose, is not believed. The manner in which it is proposed to provide against this objection in the use of the atmospheric pile in the present case, or at other points of equal exposure, will be explained in the project now submitted.

Having premised that though a solid structure at New South Shoal, were it possible to erect one at that exposed point, might withstand the direct assaults of the sea, it nevertheless would be overthrown by the wasting of the sands on which it stands, through the insidious workings of the waves acting on the mass, and that to meet the case, it would be necessary to adopt a foundation; which, while it afforded the necessary area and strength to support the required superstructure, would offer no impediment, practically considered, to the motion of the currents or the waves; having also expressed the opinion that works combining these pre-requisites may be founded on submerged soils by means of Mitchell's screw-pile and Pott's pneumatic-pile—and further, that for reasons which it is conceived are indisputable, the former cannot be applied to that use at New South Shoal—the bureau will already be prepared to learn that, as the practical application of the latter is not open to the same objections, it is recommended for the present design.

The instructions of the bureau calling for a plan and estimate for a beacon on New South Shoal are predicated on so much of the "Act making appropriations for light-houses, light-boats, buoys," &c., approved March 3, 1849, as is contained in the following words, to wit: "For a screw-pile beacon or other practicable structure on New South Shoal, off Nantucket, discovered by the survey of the coast, \$25,000, to be expended under the direction of the Bureau of Topographical Engineers." A plan and estimate for a beacon are accordingly herewith submitted. Considering, however, that a beacon would mark the shoal during the day only, and that the risks and dangers of navigation are more imminent and numerous at night, and especially during the boisterous season, when the nights are longest, it has been deemed advisable, in anticipation of the approval of the bureau, to prepare also a plan and estimate for a light-house for the same point. In doing this, less hesitation has been felt, because, in the erection of any work at a position so exposed as the one under consideration, the only real difficulty consists in establishing the foundation; and because the greater cost of a lighthouse, although certainly considerably more than for a beacon, bears no sort of reasonable comparison when the superior and continuous usefulness of the lighthouse is considered. It was also conceived that the plan might be so arranged, that in case the beacon structure should be adopted, and should, when raised, be found competent to resist the shocks of the ocean, the project of a lighthouse might be finally executed. In contemplation, therefore, of that ultimate object, the dimensions of the proposed beacon, in general and in detail, have been enlarged beyond what might be otherwise considered sufficient; but whatever may be the excess thus caused in the estimate for the beacon, it is confined almost wholly to the foundry cost of the structure. In other respects, unless the size of the work should be greatly reduced, the expenses, excepting those in which time enters, would remain nearly, if not quite, the same.

As the two structures, as already stated, are in part common to each other, a description of the lighthouse, as the larger of the two, will, with occasional reference to the beacon, be sufficient for both.

The foundation is composed of iron piles, so grouped together as to form an octagonal prism 50 feet in diameter, and about 42 feet in height. From this prism, as a base, rises a truncated pyramid, composed also of iron piles, which inclining inward 6 on 1, for a further height of 120 feet, fall within the diameter of 10 feet, and are received and secured in a great ring-piece, which, in turn, is surmounted by the watch-room and lantern, making the whole height 185 feet. The piles, one at each angle, and one at the centre of the octagonal prism, are of 12 inches; those of the truncated pyramid in three lengths of 12 inches, tapering to 6 inches. The entire structure including the prism for the length of the piles, is braced horizontally in seven planes, and diagonally between every consecutive two of these planes, except where the dwelling of the light or cage of the beacon, as the case may be, interferes, when these are in part omitted. The dwelling stands 40 feet above the highest tides, is composed of three stories of nine feet each, and communicates with the watch-room and lantern above by a spiral stairway in a column of wrought-iron 8 feet in diameter. The two lower stories are 30 feet, and the upper story 20 feet in diameter; the first and third stories, as well as the roof of the dwelling, and the watch-room and lantern being surrounded by galleries. The watch-room and the lantern are 12 feet in diameter; the former 6 ft. 9 in. in height, the latter about 12 feet, with the roof and ventilator, &c., 20 feet in height. The beacon occupies but two of the three lengths of piles forming the pyramidal frustrum of the larger structure. The cage, the bottom of which is elevated 60 feet, and the extreme top 108 feet above the level of the highest water, is composed of columns arranged in the form of a cylinder, 24 feet in diameter and 24 feet in height, surmounted by a canopy giving it a further height of 24 feet.

These are the outline or main features of the two structures. The details will be better understood from the drawings communicated herewith, than from the most lengthened and minute description. They consist of an elevation and vertical section of each work on a scale of 4 feet to an inch (1-48), and sixteen sheets of details on the same, and double the scale; and will show, not only the manner of bracing pro-

posed, but also the character of the cage, the arrangement and finish of the dwelling, and passage thence to the watch-room and lantern of the latter; and also the arrangements for securing the boat for taking in stores; the position of the fog-bell; the keeping of the oil, water, and fuel, &c. &c.; and all other particulars, even to the size of the material employed, &c. Talbotypes of the elevation and vertical section of each reduced in scale to about 1-282, are also appended to the report.

It is now necessary to explain in what manner it is proposed to establish either work on the shoal. It was stated, when describing the applicability of screw-piles and pneumatic-piles for founding the proposed structures, that as the latter required no mechanical force to insert them into the bottom, for employment of a fixed staging, from which to apply such force as was required in the use of the former, would be unnecessary; and that although a floating body might, by well digested measures, in favourable weather, be successfully employed in sinking them singly, it would not be practicable to give the number of piles required to found the work their proper relative positions from so unsteady a footing. The utter hopelessness of constructing a fixed platform, under the circumstances, at so exposed a point as New South Shoal, at least by such time in the working-season as to render it available for the intended purpose, was also shown. What other course, then, shall be adopted in the emergency? It is, in my opinion—not lightly formed—to carry out and deposit on the shoal, by one bold measure, the entire lower or foundation portion of the structure described as the octagonal prism, and by Dr. Pott's process, so simple in its character and wonderful in its results, to sink it in the sand to the required depth. It will not escape attention, that in taking this course, the necessary bracings, down to the very level of the shoal, will be secured to the work; whereas, in putting down the piles separately, the attaching of them is barely possible under the most favourable circumstances, at so exposed a point.

The foundation or lower portion of the structure, already in part described, is formed of nine piles, occupying the angles and centre of the prismatic figure, bound together by two sets of horizontal braces—one 20 feet from the bottom, the other at the top—and by three sets of diagonal braces between these planes. It is necessary to state here, that the lower part of each pile is received by a cylinder having a conical base or foot, through which, by a separate pipe, provided for the purpose, extending to the top of the framing, it is designed to excavate the sand by the pneumatic process. By this arrangement, the advantages of the two systems—of the screw-pile and pneumatic pile—have been combined; the means, on the one hand by which the soil may be penetrated to the required depth, and the use, on the other, of a shaft, presenting, with a proper bearing, the least exposure, strength considered, to the action of the sea. For the character of this arrangement, and for all other details, reference is respectfully made to the model of the foundation section, on the scale of 1-24, which will be deposited in the bureau. The work, as designed, including the cylinders with the conical bases to receive the solid piles, and all necessary appendages, such as air pump and receivers, and air and sand piles, &c. &c., for sinking it into the bottom, weighs 238 tons. To receive and float this great weight, distributed as it is throughout such large bounds, will require twin-camels, each at least 100 feet in length, 15½ feet beam, and 10 feet depth of hold, or say about 160 tons. These camels, when light, will draw little over 3½ feet of water; and when loaded about 7 feet. Carrying the foundation as proposed, with the lower set of horizontal braces resting on the rail, the cones or shoes of the cylinder will extend nearly 4½ feet below the keels. In this same position, 61 tons of the weight will be suspended below, while the balance, or 177 tons, will stand above the rail. It will be time enough, should the present design be approved and ordered to be carried out, to digest all necessary details, to insure a full efficiency to the camels; to determine whether they shall consist, as now proposed, of two similar vessels of ordinary model, or of two having, when combined the general outline of a single vessel; the most perfect way of securing them to each other, and to their burden; the best arrangement for towing, mooring, and flooding; and, finally, the proper mode of removing them from under the framing when it rests in position on the shoal. It is even now evident that it is desirable so to modify the lower framing that a larger proportion of the weight may be carried below the body of the camels than the present arrangement provides for. Again, it further appears, as far as experiments with the model may be relied upon, that to insure the uniform descent of the foundation, it is necessary to have either an air-pump for each pile, or, if one air-pump only is used, to communicate with the soil-receivers by air-pipes of equal lengths. The weight on each pile, when resting on the bottom, is 26-2 tons, which distributed over 19-6 feet, the area of the base of the cones, 5 feet in diameter, gives 1-33 ton for each foot. The entire weight of the lighthouse structure is 640 tons; of the beacon, 466 tons; giving 71-1 tons on each pile, or 3-6 tons on each superficial foot in the case of the first, and 51-6 tons, on each pile or 2-6 tons on each superficial foot, in the case of the second work. To sink the cylinders 19 feet in the sand, the depth proposed, will require the raising in each case of a column of sand of that height, 5 feet in diameter, or 373 cubic feet, or about seven times the contents of the receivers, calculated at 54 cubic feet. As there is, however, a large admixture of water with the sand, raised by pumping, the descent of the cylinders will necessarily call for the filling of the soil-receivers much more frequently.

In recommending the carrying out of the foundation in one body to the shoal, the hazards which belong to the entire proceeding, from the departure of the camels with their burden from the selected harbour, to their arrival, and the complete establishment of the work at the site, are, it is believed, in no wise underrated. So far from this being the case, it is not improbable that, by dwelling on the subject, I may have rather magnified them. The towing the camels in a sea-way with their load, a large proportion of which is, on the one hand, high above their decks, and on the other, far below their water-line; the placing, and then securely mooring them at the selected site; the flooding the camels, and then relieving the foundation, on resting on the bottom, from them, without injury from the heave of the sea to either, particularly the former; and, lastly, the sinking of the piles by the pneumatic process, are all operations, under the circumstances, of much delicacy, liable to great risks, and, as a consequence, involving the issues in much uncertainty. The velocity and ever-changing direction of the currents at the site, and through the group generally; the exposure, and the distance of the shoal from the land; and, above all, if it be possible to draw a distinction where each controlling condition holds so important a place, the distance of the point of destination from a harbour, all go to show that the difficulties and dangers of the operation are of no ordinary character. As its success depends on the vicissitudes of the weather, that is the true turning-point in carrying out the final

design. But in making these observations, I desire also to say, that, in my opinion, the question is not, as in most cases, a mere selection from several plans, but is reduced to the alternative of adopting the plan now suggested as the only one that has a chance of success, or the entire abandonment of the design, to mark the position of the dangerous shoal in question.

The plan of operations for the erection of the lighthouse calls for four and a half years, thus distributed : one year and a half in constructing and setting up and taking down the work at the foundry, and transporting it to the selected harbour of refuge and departure ; the first season at the shoal in establishing the foundation section at the site : the second season in raising and bracing the pile-framing, and forming the iron work of the dwelling, &c.; and the third and last season in finishing the interior of the dwelling, &c., completing the lantern, and setting up lighting apparatus, constructing hoisting-davits, &c., putting up fog-bell and striking-machinery, water and oil-tanks, &c., furnishing, painting, &c., and lighting. The plan of operations for the erection of the beacon covers three years, employed as follows: one year at the foundry in forming structures, &c.; the first season at the shoal in fixing the foundation section; and the second and last in building up and bracing the framing and forming the cage, &c.

Conceiving, as already remarked, that the placing of the foundation constitutes the main obstacle to a successful issue to the proposed project, a description of the operations to carry it out will be confined to an outline of what would probably be the course in regard to that measure. It is necessary previously, however, to state, that although there is as little as 8 feet at low water on the shoal, and an area of considerable extent within the two fathom curve at the same stage of the tide, it has been thought advisable to design the work for a point in a depth of 14 feet on the land-side, and midway of the length of its crest, which standing in the relation somewhat of a breakwater, will afford a partial protection to the work against the deep-sea wave. It should also be stated that as Nantucket, the nearest harbour to the shoal, has but 6½ feet at low water at the entrance, Edgartown, the next nearest, with 15 feet at the same stage of the tide, is selected as the harbour of departure and refuge in the proposed undertaking.

The precise site of the work on the shoal having been marked out by disc-buoys, having mooring anchors laid down, &c., and the double section composing the foundation put together on the camels, a favourable state of the weather, with the wind offshore, should be taken to set out from the harbour—so timing the departure as to reach the shoal, distant, as already stated, forty-two miles, by the dawn of day. The time required to make the trip will depend, of course, on the speed at which the steam-tugs can tow the camels with their burden. This will probably be found to be somewhat between three and a-half and seven miles per hour; but this point should be settled previously, by one or more experimental trips off the mouth of the harbour. These trials may also be found necessary to ascertain how the camels carry in a sea-way, so as properly to adjust the burden on them, &c. As the draught of the foundation structure, as carried on the camels, is less by 2½ feet than the depth at low water at the point at which it is proposed to found the work, the arrival at the shoal need not be governed by the stage of the tide, though high-water is preferable, as all other conditions being the same, the swell of the sea, in consequence of the greater depth is then least. Having arrived at the shoal, the operation of depositing the foundation at the site is one which, in case the weather continues propitious, should require but little time to accomplish. As the plan of the work is based on a regular figure, and may consequently take any position relatively with the shoal, the steam-tugs should tow the camels into place on the direction of the current as it then runs, when the anchors will be let go, and the other appliances prepared for the purpose put in requisition, to moor them as immovable as the circumstance of the case will admit. The next proceeding in course is to flood the camels, and bring the foundation on the bottom, when the former may be drawn by the steam-tugs from beneath the latter. A full and well-instructed force, already occupying the work, will then commence sinking the structure by the application of the steam air-pump, by excavating the sand under the piles through the cones forming their feet, and continue vigorously to prosecute the operation until it descends to the required depth. Twenty-four hours of favourable weather, would, it is confidently believed, suffice for the complete and satisfactory accomplishment of this most novel proceeding; and even half that time to place the work in safety on the shoal against any ordinary contingency of weather, in case the state of it at the time should prevent the sinking of the cylinders. The great breadth of the structure compared with its height, and the absolute regularity of its figure, combined with its enormous weight, and the smallness of its surface exposed to the blow of the sea, all go to warrant a confidence in this belief.

Although the range for an elevation of 137 feet (the least height by the design of the focal plane above the level of the sea,) and the deck of an ordinary size vessel, is quite within the powers of the second order of lenticular lights, it is deemed advisable, in view of the importance of apprising navigators of the position of the shoal at the earliest moment, to provide in the estimate for one of the first order, which by the increased volume of light may not only be seen under a less favourable condition of the atmosphere, but also be distinguished aloft from ships of the largest class when actually below the horizon. The difference in the first cost of the two orders is about $3000, the difference in the maintenance about $350, annually—confined in the present instance, from the character and isolated position of the light, requiring no larger force, to the greater consumption of oil—say 250 gallons—and the slightly increased cost of the smaller accessaries.

On the Cause of the Aurora Borealis;

By Prof. A. de la Rive.*

When in June 1836, I published in the Bibliothèque Universelle a note on the origin of hail and atmospheric electricity, I already foresaw that the same cause would explain the aurora borealis, and the irregular and diurnal variations of the magnetic needle. As I had not then seen an aurora, I withheld at that time this application of the principles. Since then I have witnessed two fine auroras, and the appearances observed, especially during that of November 17, 1848, have confirmed my view of the nature of the phenomena, while they also accord with the observations of others, especially with those of Hansteen, Bravais and Lottin, and also with the many interesting details in Humboldt's Cosmos. My subsequent electrical experiments throw additional light on the origin of the aurora.

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* Mem. Soc. de Phys. et Hist. Nat. de Genève, xiii, and Bib. Univ., xxiv, 337, Dec. 1853.

This last statement indicates that I regard the cause as electrical. This view has often been presented before, and was brough forward by Arago at the time of Œrsted's discovery. Yet no one, to my knowledge, has explained the mode of action and production of the electricity, or the attendant phenomena resulting from this cause.

Without going into any historical details, I will briefly describe the aurora borealis itself and its effects, and then pass to my own theory, the accordance of which with facts I shall endeavour to point out.

1. Description of the Aurora and its accompanying effects.

I cite the following details principally from the Cosmos. They are derived mostly from the descriptions of Hansteen, Bravais, Lottin, and other travellers who have been in favorable places for observing the aurora. The learned author of Cosmos has grouped the facts with great skill, presenting in an admirable manner the prominent points, and seems with scientific tact to reach towards the true theory of the phenomena which he describes.

An aurora borealis is always preceded by the formation in the horizon of a kind of nebulous veil, which rises slowly to a height of four to six or eight, or even ten degrees about the magnetic meridian; the sky though before pure, becomes darkened, and over this obscure segment, whose color varies from brown to violet, the stars are seen as through a thick haze. An arc of light, first white, and afterwards yellow, borders the dark segment. Sometimes this luminous arc is agitated for hours by a sort of effervescence, and a constant change of form, before it rises into the rays or columns of light which mount to the zenith. The more intense the emission of the polar light, the brighter are the colors that appear, which from violet and bluish white pass by intermediate shades to green and purplish red—just as electric sparks are coloured only when the tension is strong, and the explosion violent. Sometimes the columns of light proceeding from the luminous arc are mixed with blackish or smoky columns; sometimes they rise simultaneously from different points of the horizon; or they may unite in a sea of flames of indescribable magnificence, the form and brilliancy of which are in incessant change. The motion gives greater visibility to the phenomenon. Around the spot in the heavens towards which the dipping needle points, the rays appear to cluster and form a corona. Rarely the aurora continues till the corona is on all sides complete, and when this happens, it announces that the end of the exhibition is near at hand. The rays then become feebler, shorter, and less bright in their colors. Soon, only large nebulous motionless spots, of a pale or ashy tint, are seen over the celestial vault; and finally, traces of the dark segment in the northern horizon, where the appearances began, alone remain.

The connection between the polar light and a certain kind of cloud is recognized by all observers, who affirm, that *the polar light sends forth its brightest columns when the upper regions of the air contain masses of cirro-stratus clouds of great tenuity, which tend to form a corona around the light.* Sometimes the clouds are grouped and arranged like the auroral columns; and in this case they appear to disturb the magnetic needle. After a brilliant aurora, the trains of clouds in the morning have sometimes been found to indicate the positions of as many luminous columns during the night.

The absolute height of the aurora has been variously estimated. For a long time it was supposed that it might be ascertained by the observations of distant observers on the corona: but it is now well known that the corona is only an effect of perspective, due to the apparent convergence of rays which are parallel to the dipping needle; so that each sees his own corona, as each his own rainbow. Moreover the aspect of the phenomenon depends on the position of the observer. The seat of the aurora is in the upper regions of the atmosphere; but sometimes it appears to be produced within less elevated regions, where clouds are formed. Such observations as those of Capt. Franklin appear to establish the latter conclusion, who saw an aurora which lighted up the under surface of the clouds, whilst Mr. Kendall, two or three miles distant, saw no light whatever, although awake and constantly observing the sky. Captain Parry also asserts his seeing an aurora depicted on the flank of a mountain: and it is said that a luminous arc has been seen on the surface even of the sea, around the magnetic pole.

Mairan and Dalton believed the aurora borealis to be cosmical, and not atmospheric. But Biot, who had an opportunity of observing the aurora at the Shetland Isles in 1817, proved it to be an atmospheric phenomenon, from finding that it did not partake of the movement of the stars from west to east, and consequently moved with the earth's rotation. Since then, nearly all observers have come to the same conclusion; and in particular MM. Lottin and Bravais, who have observed more than 143 auroras, and given detailed description of them.

It is therefore quite certain that the aurora is not extra-atmospheric. To the evidence from its appearances, we may also add the crackling noise sometimes affirmed to be heard by the inhabitants in the far north, and the sulphurous odor which also has been observed. And, in fine, if the phenomenon is wholly beyond our planet, why should it be located about the polar regions? M. de Tessan, in the voyage of the Venus around the world, saw a fine aurora australis, which he describes with care. It was 14° in height, and the centre of the arc was in the magnetic meridian. He heard no sounds connected with it, which he attributes to its distance: but he mentions that M. Verdier, a French naval officer, on the night of Oct. 13th, 1819, while on the coast of New Holland, heard distinctly a kind of crepitation, during a brilliant aurora. All the details mentioned by M. de Tessan prove the exactness of the observations.

As concomitant effects of the aurora, we have mentioned the crackling sound, and the sulphurous odor. M. Matteucci has also observed during the appearance of a late aurora, satisfactory evidence of positive electricity in the air. But of all the phenomena, those which are of most invariable occurrence are the magnetic. The magnetic needle undergoes perturbations, either to the west or east, and usually the latter. These disturbances vary in intensity, but never fail of taking place; and they are at times manifested in places where no aurora is seen. This coincidence of magnetic disturbance with the aurora, shown by Arago to be without exception, from many years of observations, enabled this philosopher to tell, while in the basement of the Paris Observatory, when there was an aurora in our hemisphere. M. Matteucci has observed this magnetic influence under a new form. During the aurora of Nov. 17, 1848, the armatures of soft iron used with the Electric Telegraph between Florence and Pisa remained attached to their electro-magnets as if strongly magnetised, although the apparatus was not in action, and the batteries out of use.

M. de Tessan cites an observation made in 1818, by M. Baral, another French naval officer, on the same coasts of New

Holland, who found that he had been making a wrong course from following his needle; there had been no storm, and the compass had not been touched. But on the evening of the same day, there was a brilliant aurora, and to this he attributes the deviation—a conclusion which could not have been dictated by theory, since at the time (in 1818) the relations between electricity and magnetism were not known.

The intimate connection between the aurora and terrestrial magnetism, has led Humboldt to designate as a *magnetic storm* a succession of disturbances of equilibrium in the magnetic forces of the earth. The presence of this storm is indicated by the oscillations of the magnetic needle, and afterwards, by the aurora, of which the oscillations are precursors, and which also put an end to the storm, just as the lightning in an ordinary electric storm announces that the equilibrium, before disturbed, is again established in the normal distribution of the electricity. Humboldt finds proof, amounting to experimental certainty, in the discovery of Faraday, who produced light by the action of magnetic forces alone, that the earth, by virtue of its magnetism, has the property of emitting light quite distinct from that which is afforded by the sun.

While recognizing the truth of the analogy which Humboldt here traces out, we should recollect, that it is not of itself, but because it produces electric currents, that magnetism gives out light; the light is purely electrical in origin. Magnetism produces luminous phenomena only because it can disengage electricity, and it is probably in this point of view that Humboldt says in a general way that it is a source of light.

It is hence in electricity, and in the influence which this agent in a state of motion, and magnetism, mutually exert, that we must look for the cause of the aurora borealis. This is the view which I would sustain, and to the force of my demonstration, I propose to bring some direct experiments, as well as the results of numerous observations through past years.

2. Proposed Theory.

The atmosphere in its normal state is constantly charged with a considerable quantity of positive electricity, which increases as we ascend, starting at the earth's surface where it is zero.

I will not inquire into the origin of this electricity: what is certain is that its production is connected with the action of the sun, since its intensity is subject to diurnal variations. It may be a question whether the sun acts directly, either through its light or its heat, on the constituents of our atmosphere, and so produces the electricity; or whether it is an indirect effect of the solar rays causing evaporation from the waters of the seas, or the vegetation of the land. It is probable that both causes act: yet I am inclined to regard the first as most general and most constant. But this is of little importance here: the fact of the constant charge of positive electricity in the atmosphere and of negative electricity in the earth, is abundantly proved, and this is sufficient for our explanations.

This constant production of the two electricities must necessarily be attended by a recomposition or neutralisation; otherwise the contrary electric states would acquire an infinite tension, which is contrary to observation. This recomposition or neutralisation takes place in two ways, one irregular and accidental, the other normal and constant.

The first method is exhibited under various forms. Generally it is the simple humidity of the air, or the fall of rain or snow, which causes the neutralisation. At other times, it is the thunder-bolt, which exhibits in an energetic manner the tendency to union in the two accumulated electricities, one in the air, the other in the ground. The winds in certain cases, by mixing the air from the earth's surface which is negative like the earth, with the positive air of a region more elevated, leads to a neutralisation of the two electricities, causing either storms or an exhibition of heat lightning. In winter, the air being constantly more saturated with moisture, the direct neutralisation is effected through the aqueous vapors and there are therefore fewer great disturbances and consequently fewer storms; and at the same time, as Arago has remarked considering the number of storms, the lightning strikes the earth more frequently in winter than in summer.

In general, the influence of the hygrometric state of the air on the manifestations of atmospheric electricity is almost as great as that of the cause itself which produces this electricity; for this influence makes itself felt both in the production of the accidental phenomena just enumerated, and in the indications of the electrometer by which we ascertain the normal electric state of the air for the hours of the day, and days of the year. Hence it is difficult to deduce from these observations even the intensity of the atmospheric electricity for any given moment, seeing that it is impossible to separate this original intensity from the degree more or less decided which the electric registers may manifest.

Let us now pass to the second mode of neutralisation of the two electricities, which I regard as normal and regular.

The positive electricity, with which the upper beds of the atmosphere are charged, will traverse them freely, because of their high state of rarefaction. But in the polar region, where the intense cold constantly condenses the aqueous vapors, it finds a portion of the atmosphere saturated with humidity, giving rise to mists; and by this means it may easily pass to the earth and combine with the negative electricity with which the earth itself is charged. It consequently results that there are constant currents of positive electricity rising from different points of the earth's surface into the upper regions of the atmosphere, which pass towards the poles, and then return beneath the earth's surface towards each of the points whence they have started. The currents of the northern hemisphere should go to the north pole, and those of the southern, to the south pole. In the equatorial regions, the position of the sun will determine the dividing line between the two systems. We may add that the experiments made with the electric telegraph have demonstrated that the terrestrial globe is an almost perfect conductor of electricity, compensating by its mass, for what it wants in the conductibility of the materials which constitute it. Thus the existence of the currents, whose course I have traced, rests on well established principles, with a foundation of simple experiment.

But more than this: their existence is demonstrated by facts long studied and established,—those pertaining to the diurnal variation of the magnetic needle.

I do not examine here into the origin of the earth's magnetism, a subject to which I shall have occasion to return in another work; for the present, I only say that I do not regard the disturbing causes of the direction of the magnetic needle as of the same nature with those which determine this direction. I content myself now with regarding the earth as a large magnet having its two poles; and I study only the causes that modify the direction which, in this quality of a magnet, it tends to impress on the magnetic needle. These causes are the electric currents, whose existence I have just shown; they well explain the diurnal variations. These variations, in fact,

consist in this, that in our hemisphere, the north pole of the needle moves to the west, during the morning until half-past one P. M., and then returns to the east during the rest of the day, to remain stationary during the night. But this deviation is precisely that which should be occasioned by currents passing along the surface of the globe from the north pole to the equator, augmented, in intensity with the heat of the day and diminishing as it decreases. The diurnal variation is at its maximum (13′ to 16′) in those months in which the sun is longest above the horizon, May, June, July, August. It is at its minimum (4′ to 5′) during the winter months. The variation is greater as we pass from the equator towards the pole; but it is evident, that if the currents, proceeding from different points of the earth's surface heated by the sun, rise in the atmosphere to redescend at the polar regions, and thus traversing the globe, reach their points of departure, the nearer the needle to the magnetic pole, the greater the number of currents that will act upon it: near the equator, it will not be subject to any influence from the currents which are formed beyond the region around the needle. In winter these differences are less sensible, because the currents from the equatorial regions are the only ones whose effects will be very decided, on account of the little difference of temperature which exists in this season between the earth's surface and the upper regions of the atmosphere in the temperate and especially the polar zone.

Finally, according to our theory, the same effects should be manifested in the southern hemisphere, only that all is reversed; and this is fully established by the various results of recent observers, including those of Colonel Sabine and a large number of travellers.

I should however acknowledge that there are some anomalies, either in the hours or in the direction of diurnal variation, at certain places, especially at St. Helena and the Cape of Good Hope, anomalies which it is difficult to explain by the theory proposed. But I am convinced that when further examined, they will be found to be due to local and accidental causes, such as the vicinity of the sea, which influences very notably the diurnal variations of temperature and especially their amplitude and the hours of the maximum and minimum of heat. The question whether there are not places of no variation, proposed by Arago, is of little importance in this connection The points of the earth's surface without diurnal variation, will be those where the two currents originate, and whence they proceed from the right and left towards the two poles: they are situated in the equatorial regions, but they cannot well be laid down, as their position will vary with the sun, the temperature, the winds, and other disturbing causes.

But I do not dwell on this point, as my object is not to treat of the diurnal motions of the needle. My end is simply to prove from the diurnal variations, the existence of the terrestrial currents. In continuation, we may obtain another proof still more direct, although less general, of the presence of these currents, by making use of the telegraph wires for collecting them. This I have done in England, as has also Mr. Barlow; and M. Baumgartner has performed similar experiments in Germany. In these trials, the currents have in all cases been detected by means of the galvanometer. M. Baumgartner, having introduced a very sensitive galvanometer into the circuit formed by the telegraph wire between Vienna and Prague, which has a length of about 61 miles, obtained the following results when the two extremities of the wire were buried in the earth.

1. The magnetic needle never stood at zero, but was more or less deviated.

2. The deviations were of two kinds, some of large extent, even 50°, others small, varying from 1° to 8°;—the former not common, and changing in direction and intensity, so that no law can be discovered; the latter on the contrary subject to a simple law, and being very regular when the air is dry and the sky serene, but with many anomalies when the weather is cold and rainy.

Mr. Barlow has made numerous observations, and obtained results demonstrating the exactness of the principle, which I have laid down. Four main lines starting from Derby, were used in his experiments, two running towards the north and northeast, and two towards the south and southwest. The direction of the currents perceived on the first two lines, was always contrary to that of the currents on the two others, as ought to be the case, on the theory proposed. But the most remarkable fact, is the perfect concordance which these observations have proved to exist between the movement of the needle of the galvanometer placed in the circuit of the telegraph wire and the diurnal variations of the magnetic needle. The diurnal movement of the needle of the galvanometer is subject to disturbances in intensity more or less continued, during storms, and also when the aurora borealis is visible; and so also is this true of the compass needle. There is this difference, that the currents acting on the latter, circulating beneath the earth's surface, should not be subject to disturbances like those which happen to the telegraph wires through the influence of the electrical condition of the atmosphere about them.

The existence then of electric currents circulating beneath the earth's surface appears to us to be well demonstrated; and once proved, it leads necessarily to the conclusion that it is a consequence of the normal and regular reëstablishment of the electric equilibrium between the earth and its atmosphere, which is broken essentially in tropical regions; whilst the electric discharges, more or less intense, which take place between the earth and the air are the accidental and variable means for the reëstablishment of this equilibrium. We may now see how the explanation of the phenomena of the aurora both north and south, flows necessarily from the formation of these electric currents circulating from the equator to the two poles in the upper regions of the atmosphere, and from the two poles to the equator along or beneath the surface of the globe.

As we have said above, the positive electricity with which the atmosphere is charged, especially in the upper regions, is carried towards the two poles either by the greater conductibility of the upper and most rarified strata of the atmosphere, or by the currents of air in the upper regions which move from the equator to the two poles. It is consequently through the vapors which are constantly condensed in the forming mists in the polar regions that the positive electricity should find its passage into the earth, and also therefore its discharge. This discharge when possessing a certain degree of intensity should be luminous, especially if, as is almost always the case near the poles and sometimes in the upper regions of the atmosphere, it encounters in its course icy particles of extreme minuteness, which form the haze as well as the more elevated clouds.

The formation of lunar halos which generally precede the appearance of an aurora, and the fall of rain or snow which also is often a prelude to it, are a proof of the presence in the atmosphere of these fine needles of ice, and of the part they play in the phenomenon before us.

This attenuated mist, rendered luminous by the transmission of electricity, ought to appear under a regular form, like an illuminated surface of greater or less extent, and more or less broken. It should spread outward from the poles, forming as a first appearance the auroral bank like a veil in the north. The tenuity of this veil is such that the stars may be seen through it, as has been remarked by all observers. MM. Bixio and Barral, in the balloon ascension which they recently made, suddenly found themselves,—although the sky was quite serene and the atmosphere without a cloud—in the midst of a veil or mist, which was perfectly transparent, consisting of a multitude of small icy needles so fine that they were hardly visible. Such are the needles which become luminous by the passage of the electricity, which determine the formation of halos as has been rigorously demonstrated, and produce by condensation the aqueous vapors in their passage through the air towards the earth, the fall of snow or rain, or sometimes under peculiar circumstances, hail.

Now if we inquire what should pass in the portion of the luminous mist nearer to the earth's surface, we shall conclude that the vicinity of the magnetic pole must exert a decided influence on this electrised matter,—for it is in fact a true mobile conductor traversed by an electric current.

In order to obtain a correct idea of this action, I have endeavored to imitate artificially the process of nature, and with this view, I contrived the following experiment.

Into a glass globe, 30 to 40 centimeters in diameter, I introduced through one of its two opposite tubulures, a piece of soft iron wire, about 2 centimeters in diameter, making it to terminate at the inner end very near the centre of the globe, while the other end was exposed out of the globe. The wire was covered through its whole length, excepting its extremities, by a very thick insulating bed formed first of shell-lac, then with a glass tube covered itself with shell-lac, then with a second tube of glass and finally with a bed of carefully applied wax. The insulating layer in all was a centimeter thick, giving 4 centimeters for the thickness of the bar thus covered. Within the globe, a ring of copper surrounded the bar and its insulating bed, at the part most distant from the tubulure. This ring was arranged to be put in communication with a source of electricity exterior to that of the bar by means of a metallic wire insulated with care which passed through the tubulure and ended without in a hook. A stopcock attached to the other tubulure of the globe, was arranged for obtaining a vacuum. When the air within is sufficiently rarified, the hook is connected with the conductor of an electric machine, and the outer extremity of the bar of iron with the soil; by this means the electricity forms within the globe a luminous sheaf, more or less irregular, which passes from the ring, and terminates at the inner extremity of the soft iron. But immediately on placing the outer extremity of the soft iron on the pole of an electro-magnet, the electric light takes a wholly different aspect. Instead of proceeding indifferently from different points of the upper surface of the cylinder of iron, it proceeds from all points in the circumference of this surface, so as to form around it a continuous luminous ring. This is not all: this ring has a movement of rotation around the magnetized cylinder, sometimes in one direction and sometimes in the other, according to the direction of the electric current, and the nature of the magnetization. Finally, jets of brilliant light are seen to proceed from this luminous circumference, which are distinct from the rest of the mass of light. When the magnetization ceases, the luminous phenomena return to the condition familiar in the experiment, known under the name of the *Electric Egg*.

There is some advantage in using for the experiment here described Armstrong's hydro-electric machine, in which the boiler is made to communicate with the hook which is united by a metallic connection to the ring of copper within the globe, while the conductor which receives the vapor is put in connection with the bar of soft iron. Thus we have in the globe an electric current of great intensity which may be changed in direction, by inverting the connections.

(*To be continued.*)

The Mints of the United States.

BY PROFESSOR WILSON.*

The transmissions of gold from the new state of California have caused a corresponding increase in the gold currency of the States, and have invested the Mint operations with more general interest than under the previous ordinary circumstances they possessed. The same condition of things exists in this country; and as it is intended to establish a mint in the gold producing colony of Australia, I thought it desirable to obtain as much information as I could in reference to the organisation and working details of those in the United States.

The head establishment is at Philadelphia, and is called "The Mint;" there are also three "Branch Mints;"—at New Orleans, in Louisiana; at Charlotte, in North Carolina; and at Dahlonega, in Georgia, respectively. The Branch Mint in California, and the Assay Office in New York, are not yet completely organised.

At the Mint in Philadelphia, gold, silver, and copper, are coined; at New Orleans, gold and silver are coined; while the branches at Charlotte and Dahlonega coin gold only. At "The Mint," the executive staff consists of a director, treasurer, chief coiner, melter and refiner, engraver, assayer, and assistant-assayer. At the New Orleans Branch Mint the staff consists of a superintendent, treasurer, melter and refiner, and coiner; and at each of the other two branch mints there are but three officers,—superintendent and treasurer (combined), assayer, and coiner. The several duties of these officers, the remuneration they shall receive for their services, and the amount of security they shall give for the due performance of them, are duly prescribed by an Act of Congress supplementary to the Act entitled "An Act establishing a Mint and regulating the Coins in the United States;" this latter act giving all the details referring directly to the coinage of the country.

At the United States Mint at Philadelphia, the salaries are fixed as follows:—Director, £3500; treasurer, $2000; chief coiner, $2000; melter and refiner, $2000, assayer, $2000. At the New Orleans Branch Mint the salaries are, to the superintendent, $2500, and $2000 each to the other officers; and at the other branch mints the superintendents receive $2000, and the other officers $1500 respectively. In each of the establishments the appointment of assistants, subordinate officers and servants, is left entirely in the hands of the chief of the different departments.

In visiting the Mint at Philadelphia I had the advantage of being taken through the several departments by the chief coiner, Mr. Franklin Peale, and the melter and refiner, Professor J. C. Booth, who kindly furnished me with the following de-

* From the Special Report on the New York Industrial Exhibition.

tails of their operations. As the gold is brought to the Mint in various quantities and in a crude state, it passes necessarily through the department of the refiner before it reaches that of the chief coiner; I therefore give the actual details of the refining operations upon sundry deposits of gold, amounting in the aggregate to $2,000,000.

The deposits are immediately weighed and a certificate of their gross weight issued. The fires having been lighted in the five furnaces of the deposit melting-room at four or five o'clock, A.M., all the deposits, amounting perhaps to seventy or eighty, are melted before noon; assay slips are then taken off and the assays finished * the next morning, after which their values are calculated by the weight after melting, care being taken to include all the grains that can be procured from the flux, pots, &c., by grinding them up under a pair of small chasers, sifting, and washing. There is a clerk and his assistant and one hand wholly engaged in performing all the weighings for the treasurer, such as weighing deposits before and after melting, ingots for coinage, fine bars, and the clippings after cutting out the planchets. There are five men in the deposit melting-room, two of whom attend to two furnaces each at the same time, one to one furnace and washing grains, and the remaining two are labouring assistants. The whole deposit of $2,000,000 is melted in three or four days in the deposit-room and assayed by from the third to the seventh day.

As soon as the first deposits are assayed, say on the third day (if expedition is necessary), or always on the fourth, they are granulated in the proportion of one part of gold to two parts of silver. The pots contains 50 lb. of gold and 100 lb. of silver, equal to 1800 oz., and each melt requires about an hour. With four furnaces (attended by four melters and two aids), there are ordinarily made thirty-two melts per day, but when hurried forty-eight melts can be made, making from one-third of a million to one-half of a million dollars per day. Two days' work, or about $650,000 worth of gold, equal in weight to one ton (avoirdupois weight), are granulated for a single setting with acid. The granulated metal is charged into large pots, together with pure nitric acid of 39° Beaumé, between the hours of seven and nine A.M. on the sixth day, and steamed for five hours. The pots made in Germany, are 2 feet in diameter by 2 feet in depth, set in plain wooden vats, lined with 3-sixteenth inch sheet-lead; a single coil of copper pipe passing around the bottom of the vat blows the steam directly into the water in which the pots are set to about half their depth.

The vats are arranged in a small house in the middle of the room with a large flue connecting with the chimney-stack, so that when in action the odour of nitrous fumes is scarcely perceptible in the building. The $2,000,000 require about sixty such pots; they are stirred about once each hour, say altogether five times with simple wooden paddles; the next day (seventh), the acid solution of nitrate of silver is drawn off by a gold-syphon into wooden buckets, and transferred to the large vat, in which it is precipitated by salt (chloride of sodium), and fresh acid added to the metals, now containing very little silver. Steaming for five hours on the seventh day completes the refining of $650,000. Early on the eighth one pot is drawn off, washed with a little warm water, and the gold-powder transferred to a filter. Fresh granulations are put into this empty pot, and the acid of the adjoining pot baled over upon them, and thus through the series, the whole being re-charged in from two to two and a-half hours. After steaming for five hours, the acid which contained but little silver from the preceding day becomes a nearly saturated solution of nitrate of silver. By this arrangement $4\frac{1}{2}$ lb. of nitric acid are consumed altogether for each pound of gold refined, and the latter is brought up to 990 at 993 m. fine,—rarely below 990. Thus every two days, 13,000 lb. of nitric acid are used. In the course of the last year 1,000,000 lb. of pure nitric acid, at seven cents per pound, equal to $70,000, were consumed.

The gold is washed with hot water on the filter during the eighth day, and until it is sweet (say by 7 P.M). The filter consists of two layers of tolerably stout coarse muslin, with thick paper between, in a tub with a false bottom, $2\frac{1}{2}$ feet in diameter and $2\frac{1}{2}$ feet deep, and mounted on wheels. One of the men remains, after washing hours, until, 7 P.M., when the watchman of the parting-room continues washing the gold and silver until sweet, *i.e.*, until the wash-water ceases to colour blue litmus paper. Early on the ninth day the wet gold is pressed with a powerful hydraulic press, and the cakes then thoroughly dried on an iron pan, at a low red heat. This process saves wastage in the melting-pot, since there is no water remaining in the pressed metal to carry off gold in its steam. The same day (ninth) the gold is usually melted with a less proportion of copper than is requisite to make standard metal, and cast into bars, which are assayed by noon on the tenth. They are then melted with the proper quantity of copper, partly on the same day, partly early on the eleventh, and assayed and delivered to the coiner the same day. On the fourteenth they are ready for delivery to the treasurer as coins.

The silver solution drawn off from the pots is precipitated in a large wooden vat of 10 feet diameter by 5 feet deep, and the chloride of silver immediately run out into large filters [6 $\times$ 3 $\times$14] where it is washed sweet. The filter is covered with coarse muslin, and the first turbid water thrown back; the filter, which is on wheels, is then run over to the reducing vats, and the chloride shovelled into them. There are four such vats [7 $\times$ 4 $\times$ 2] made of wood and lined with lead, 1 inch thick in the bottom. A large excess of granulated zinc is thrown on the moist chloride in the vats, without the addition of acid; the reduction is very violent, and when it slackens, oil of vitriol is added to remove the excess of zinc. The whole reduction occupies a few hours, and after a night's repose the solution of mixed sulphate and chloride of zinc is run off into the sewer.

About 2 tons of zinc per $1,000,000 of gold are employed; the silver, however, in this amount, say 10 per cent. by weight, should only take, by equivalents, about 2400 lb., so that nearly two equivalents of zinc for 1 equivalent of silver are used. This is found to be advantageous, as both time and space are greatly enconomised by this excess.

The day after the reduction the reduced silver is washed, and the second day it is pressed and dried by heat, the same hydraulic press as for gold being used, but with different drying-pans. The same silver is used again for making fresh granulations, but as it accumulates from the Californian gold, 10,000 or 20,000 are now and then made into coin, great care being taking in this case to aviod getting gold in it when drawing off the silver solution, and in the press.

Such are the actual working details in refining a specified amount ($2,000,000) of gold, the first-third of which is de-

* The mode of assaying is according to the "wet process" of Gay Lussac. This is too well known to need description here.

livered as coin in fourteen days after its arrival, and the third-third in eighteen days.

But as there is a bullion-fund of $5,500,000 allowed by government, depositors are paid from the third to the fifth day after an arrival, *i.e.*, as soon as the gold is melted, assayed, and its value calculated. When two heavy arrivals occur in close succession, the time of refining and coining can be shortened from 14 to 10 days.

The number of men engaged in the refining department is 14: 1 foreman, 8 for the parting process, 3 for reducing, and 2 for pressing and drying. In the gold melting-room there are 3 melters and 2 assistants. The total number of hands in the melting and refining departments is 34, including a melting and parting foreman, and 3 in the place for grinding, sifting, washing, and sweeping. This last place or sweep embraces all pots, ashes or fires, trimmings of furnaces, ashes of all woodwork, &c.

The late law for reducing the weight of silver coin necessitated an increase of force, and 15 more were in consequence employed for this purpose. While $50,000,000 in a year have been parted with the above force, they could with the same force and apparatus refine $80,000,0000 if it were required.

After many experiments upon anthracite, Professor Booth stated that he had at length fully succeeded in employing it for melting both gold and silver in the same furnaces, slightly modified, in which he had been accustomed to melt with charcoal. This change had been accompanied by great economy in the cost of material and labour, and by greater comfort to the workmen, from being less exposed to heat. The cost of charcoal (of the best quality—hard pine-knot coal) is 16 cents per bushel, delivered at the Mint; and while the cost of this fuel for all their operations in 1852, when gold was chiefly refined and melted, was about $7000, the cost of anthracite will be from $600 to $1000. In using the anthracite he found that a simple draught of air, without a blast, was quite sufficient to sustain combustion.

Californian gold frequently contains the alloy "iridosmine," which is not always detected by the assay. In order to remove it as far as possible without actually dissolving gold, it is allowed to subside, first in the granulating crucibles, and then in the crucibles for toughening (melting fine gold and copper). If the assayers report its presence in the toughened bars, they are again melted, and the iridosmine allowed to subside. By these three, and often four successive meltings, the gold is separated from its troublesome companion as far as practicable. The gold thus refined, and reduced to the proper standard [*Section* 8: "And be it further enacted, that the standard for both gold and silver coins for the United States shall hereafter be such that of 1000 parts by weight 900 shall be of pure metal and 100 of alloy; and the alloy of silver coins shall be of copper, and the alloy of gold coins shall be of copper and silver, provided that the silver do not exceed one-half of the whole alloy,"] is delivered over to the chief coiner in the form of bars or ingots of a certain weight, to be divided and shaped into pieces required for the currency of the country.

The *Coining* department of the establishment is of a power and efficiency sufficient to perform all the mechanical processes incidental to the issue of nearly 70,000,000 of pieces during the past year; and I was assured by Mr. Franklin Peale, the chief coiner, that it could have executed much more if it had been steadily employed, or fully supplied with material during the whole of that period. It is not necessary to go through the whole course of operations in this department, but to notice only such as possess novelty or present special characteristics.

The necessary power for working the machinery is obtained from a large steam-engine of the form usually known as the steeple-engine; it is a double vertical high-pressure engine, with cranks at right angles, the power being carried off by a caoutchouc belt, 2 feet wide, from a drum of 8 feet in diameter; the estimated power is equal to 90 horses. At times, this is all required, at others much less is sufficient, and in uncertain proportions; to meet this irregularity, and to insure that steadiness of motion so necessary in such delicate operations, a governor and throttle-valve of a peculiar construction have been devised which have now been in use for some time, and have produced most satisfactory results, fully effecting the purpose for which they were designed. The rolling mills, four in number, are driven by belts, at the rate of six revolutions per minute; the distances between the rollers being adjusted by double wedges, moved by a train of wheels which are connected with a dial-plate and bands, divided and numbered into hours and minutes, so as to indicate the proper thickness of the stripes of metal without the use of gauges. Gold stripes are heated in an iron heater by steam, and waxed with a cloth dipped in melted wax, and the silver strips are coated with tallow by means of a brush. The draw bench is used for both metals, and trial pieces are cut from every strip and their weight tested, preparatory to the cutting of the whole.

The cutting processes are very simple and efficient, consisting of a shaft moved by pulleys, and a 2½-inch belt, with a fly-wheel of small diameter but sufficient in momentum to drive the punch through the slip of metal by means of an eccentric of ⅜-inch, at the rate of 250 pieces per minute, which skilled hands can readily accomplish and continue until the slip is exhausted. The annealing during the rolling of the ingots into slips is performed in copper cases, in muffles of fire-clay and brick, heated by anthracite coal, three muffles or hearths being kept at a bright red heat by one fire-grate or furnace, and the distribution and intensity regulated by dampers. These annealing furnaces are recent in their construction and very satisfactory in operation; they are heated by anthracite at the cost of about one-fourth the expense of the wood previously employed.

The whitening of planchets is performed as usually by inclosing the gold in luted boxes, and by exposing the silver in an open pan, to the heat of a simple furnace with wood fuel; the drying and sifting after the action of dilute sulphuric acid, is rapidly and effectually accomplished by a rolling screen—one portion of which consisting of a pair of closed concentric cylinders, between which high-pressure steam is admitted. The blanks, with a sufficient quantity of light wood sawdust (linden or bass wood is the best), being introduced into the interior cylinder, a revolving motion is given to it by the engine for a certain time; the door is then opened and the blanks and sawdust gradually find their way into the wire screen by which they are separated, the movement being continued until the separation is complete, when the blanks are discharged at the end of the machine. An arrangement exists by which a slight inclination is given to the machine so as to direct the motion of the blanks towards the discharging end.

The milling machines are, I was informed, peculiar to this mint, and are in a great measure original, the operation being performed by a continuous rotary motion, with great rapidity

and perfect efficiency, varying in rate according to the denomination of the coin, between 200 and 800 pieces per minute, and at the same time separating any pieces that are notably imperfect.

It must be understood that the operation here termed "milling," is merely for the purpose of thickening and preparing the edge, so as to give a better and more protective border to the coin, the ornament or reed, commonly known I believe in this country as "milling," being given to the piece by the reeded collar of the die in which the piece is struck.

The coining presses, 10 in number, and milling machines are worked by a high-pressure horizontal steam-engine, made from the design and under the direction of the present chief coiner, in the workshops of the establishment in 1838.

The presses are three sizes, the largest applicable to the striking of silver dollars and the double eagles :—the second to pieces of medium value :—and the smallest to the dime, half dime, and 3 cent. pieces. The first is usually run at the rate of 80 per minute, the last at 104 per minute,—the average rate of the whole is 82 per minute. This rate can be increased if required.

If all the presses were employed in coinage at the usual rate, they would strike in one day (9 working hours) 439,560 pieces; and if employed upon gold, silver, and copper, in the usual manner, and on the usual denomination of coin, they would amount in value to $966,193.

During the past year, on one occasion 8 of the presses were run 22 out of 24 consecutive hours, and coined in that time 814,000 pieces of different denominations of coin.

The presses have been made principally in the workshops of the Mint. They possess in common with the presses of Uhlhorn, in Germany, and Thouellier in Paris, the advantage of "the progression lever," "le genou" or "toggle joint," a mechanical power admirably adapted to this operation; but in almost every other particular they are original in arrangement, being the result of experience, beginning as far back as 1836.

In order to supply these presses various means have been devised; among them and not the least important, is the "shaking box," in which advantage is taken of a disposition observable in similar bodies, or bodies of similar form, to arrange themselves in similar positions. This is a box, whose bottom is constructed with parallel grooves adapted to the size of the blanks or planchets to be arranged. A quantity of them is thrown indiscriminately into the box, which is then quickly shaken in the direction of the grooves, the pieces immediately lay themselves side by side in parallel rows, from which they can easily be lifted in rouleaux as required to be passed to the feeding tubes of the mills or presses.

It is very evident to all visiting the establishment that such a large number of pieces could not be coined and manipulated by such a limited number of hands without the aid of some labour facilitating arrangements, one of the most worthy of remark of which is the method of counting the pieces coined —if counting it can be called, for in principle it is a measuring machine. The arrangement of this counting frame, or tray, may be understood from the following sketch of its construction.

A board or tray of such dimensions as may be required, is divided by a given number of parallel metallic plates dissected into its plane and slightly elevated above it, the edges of which rise no higher than the thickness of the coin for which it is intended. The board is of such a length as will admit of a few more than the required number of pieces to be laid longitudinally in the rows and is divided across and at right angles with the rows, and hinged at a point opposite to a given number. One of those employed by this department counted 1000 pieces, that is to say, it had 25 parallel grooves or rows sufficiently long to receive 45 pieces. Now, having thrown on this board a large excess of pieces, it is agitated by shaking until all the groves are filled, and then inclined forwards until all the surplus pieces have slid off, one layer only being retained by the metallic ledge; the hinged division is then suffered to fall, which at once throws off all but the 45 pieces in the length of each row. This operation, somewhat difficult and tedious to describe, is performed in a few seconds, and results in retaining on the board 1000 pieces, each piece exposed to inspection, and the whole accurately counted without the wearisome attention—so likely to result in error—required under usual circumstances.

The very large number of pieces coined during the last year has been counted almost exclusively by two female manipulators, assisted by a man who had the duty of weighing them in addition as a testing check. The same amount of labour by ordinary means could not have been performed with fewer than thirty or forty hands, to say nothing of inferior accuracy. This machine was originally arranged and patented by the late R. Dyler, coiner of the New Orleans Branch Mint, but materially improved in its application and construction by Mr. Franklin Peale.

The balances of the Mint of the United States have received the attention necessary to an instrument of such importance in mint operations. They have been arranged and made generally in the workshops of the establishment, and operate entirely to the satisfaction of the department. It is not necessary to enter into details of their construction, as a full and minute description is given in the Journal of the Franklin Institute for July 1847. I, perhaps, ought to mention that since that appeared, some slight improvements have been made by inclosing all but the stirrups and pans in glass, by these means excluding dust and protecting them from the influence of air currents.

In concluding this brief sketch of the practical working of the two most important departments of the United States Mint, I cannot omit a reference to the very excellent remarks of the chief coiner on the employment of females in some of the operations in his department. This, he informed me, had generally excited the surprise of, and been commented upon, by foreigners, who had visited the Mint. His experience, however, had led him to believe, that in places of trust, where no great physical exertion was called for, but where accuracy and strict integrity were of first importance, the moral perceptions of the female, generally stronger and of a higher standard than in the man, would qualify her as his substitute, and thus, while opening a new field of labour for the occupation of females, would strengthen their claims to it by the superior accuracy aud economy of their work.

On Marine Boilers.

By J. A. Roebling, C.E., Niagara Falls.

The furnace of a boiler should be so constructed as to render combustion as perfect as possible, but it can do no more than produce carbonic acid. If only one-half of the oxygen neces-

sary to form carbonic acid combines with carbon, the result will be carbonic oxide, a product of imperfect combustion. A certain supply of atmospheric air, therefore, is necessary; but this supply may be too copious or too scant; it may enter the furnace too rapidly or too slow; but it cannot be too high for rapid combustion. It is also evident that the quality of the fuel must have a controlling influence upon these various conditions. Wood as fuel for marine boilers is out of the question; we can only consider mineral coals, anthracite and bituminous, as fit for ocean steaming. It is not my intention here to analyse these varieties; I only notice them in so far as their peculiar qualities require peculiar mechanical arrangements for good combustion.

Soft or bituminous coal requires more time to be consumed economically than hard coal. The large bulk of hydrogenic and bituminous compounds, mixed up with floating particles of carbon, which result from the burning of soft coal, require to be thoroughly mixed with heated air before perfect combustion can take place. The mechanical arrangements to effect this are of great importance, but may be overlooked when hard or anthracite coal is consumed. The fuel admits of a much more rapid consumption and of a powerful blast, while the draught of a soft coal furnace should not be very strong.

Experience has not yet settled the most economical speed of consumption of mineral coals. Watt's rule was to allow one superficial foot of grate surface for every ten superficial feet of heating surface; and this rule produces good results with natural draughts. The boilers of the Collins' steamers are undoubtedly the most efficient and best constructed boilers now in use, either here or in Europe. According to Mr. Isherwood, those of the *Arctic* contain 0.357 feet of grate for 11·84 feet of heating surface for every effective horse-power, or 33 feet of heating surface for one foot of grate.

According to the same author, whose account of the performance of the *Arctic*, published in the "Journal of the Franklin Institute," appears to be reliable, the average consumption of anthracite during six trips was 7,980 lbs. per hour. The aggregate grate surface of the four boilers of that steamer is 588 feet, which gives 13·57 lbs. of coal per hour for each foot of grate. In boilers of ordinary construction with natural draught, half the weight of soft coal would be a fair consumption.

Chemists who have examined the evaporative power of various fuels agree that one pound of good mineral coal, perfectly consumed, will evaporate over 11 lbs. of boiling water. Experiments on a larger scale will seldom evaporate more than 9 lbs. to 10 lbs. The boilers of the *Arctic*, during those six trips, evaporated 7½ lbs. of steam from water of 110° by 1 lb. of anthracite; and this is one of the highest results that has been obtainod in the regular working of marine boilers. It is evident, therefore, that there is room left for improvements. There is still a waste of fuel in the Collins' steamers, which arises from imperfect combustion; the result in part of a faulty construction; and, no doubt, in part is attributable to imperfect stoking. Much, of course, depends upon the mode of firing; nor is it always practicable to carry on this important part of the service according to the best rules.

In attempting to improve the construction of boilers, we may receive good hints from an examination of the condition and working of other furnaces, in which good combustion and a high degree of heat are important objects. Furnaces used in the manufacture of iron, such as blast, puddling, heating, and annealing furnaces, may be referred to.

Perfect combustion can only take place under such circumstances as are favorable to the development of intense flame and heat. Aside from the necessary quantity of air supplied at a certain rate, and heat if possible, there are other contingencies upon which success depends: a very important one is the nature of the material which surrounds the furnace, forms its walls and roof, and comes into immediate contact with the fire. The question then at once arises, can the process of combustion be successfully carried on in a narrow furnace, surrounded by iron walls and roof, in contact with water, which absorbs the heat at a rapid rate? Most certainly not. Who would undertake to heat and puddle iron in a furnace built of iron plate in contact with water? Iron water-boshes are sometimes resorted to; but they have a tendency to retard the process, and should be avoided if possible. Such furnaces are constructed of good fire-brick, which is a slow-absorbing and slow-conducting material, and after being glazed over by the strong heat will strongly reflect it. By this strong reflection and non-absorption the process of combustion is supported in an eminent degree; so much so, that a degree of heat is obtained far exceeding the temperature of any boiler furnace. As little heat as possible should be absorbed by the walls or roof of a boiler furnace; every endeavour should be made to reflect and concentrate the fire. Imperfect combustion in any furnace most generally arises from the fact that the heat is not allowed to accumulate and concentrate. The sole object of a boiler furnace should be to favour combustion, and to develop flame and blaze; and this can only be accomplished under the influence of a highly concentrated and excited action. The caloric stream thus fully elaborated, on leaving the furnace, is then allowed to expand itself; and to be absorbed by the surface of the boiler.

I may remark here, by way of general comment upon furnaces for heating houses, that the whole tribe of patent furnaces with which the country is blessed have all, more or less, grown out of erroneous notions, and are the offspring of profound ignorance of the laws of combustion and of heat. Aside from the vitiated air they supply, they are all wasting fuel at an enormous rate. This subject is better understood in the north of Europe, where long winters and scarcity of fuel have taught men to build furnaces on correct principles.

The temperature of a puddling or heating furnace has to be raised to about 3,000°: this can only be accomplished under the reflecting and reverbatory action of the walls and roof. A concentrated blast may produce a greater heat at a certain point, but it will not be diffused. Under the above circumstances, and by means of strong blast, from three to four times as much fuel may be consumed on the same surface of grate in in one unit of time as can be accomplished in a common boiler furnace. In a well-constructed heating furnace at my rolling-mill at Trenton, N. J., 8,000 lbs. of anthracite are consumed in ten hours for the heating of 18,000 lbs. of charcoal hammered blooms, on a grate of twenty superficial feet, which is equivalent to 40 lbs. per hour on one foot of grate. This cannot be accomplished in the furnaces of the Collin's steamers, which consume 13½ lbs. per hour to one foot of grate.

In the above a principle is delineated which to my knowledge has been entirely overlooked, and which must be satisfied before we can attain much higher results.

Another glaring defect in all marine boilers, those of the

Collins' steamers not excepted, is the want of room necessary for a due mixture of the gases, and a full developement of the blaze.

Large quantities of fuel in a narrow and low furnace cannot be consumed without waste. In order to become fully excited and most positive in its action, the blaze of a fire must be at liberty to extend and elongate in the direction of the draught to a distance corresponding to its bulk, and without meeting absorbing obstructions. For illustration I again refer to heating and puddling furnaces. This fact can be readily ascertained in an experimental furnace with adjustable roof. The brightest fire will burn under the highest roof, while the depressing action of a low roof will damp it, and reduce the temperature of the furnace.

Economy of space is an important consideration in the planning of a marine boiler; but this may be carried so far as to seriously interfere with the grand object of the boiler. In an efficient boiler the extension of the furnace should form an empty area, which serves as a receptacle for the caloric stream, where the gases become thoroughly mixed and fully ignited before their caloric is expended upon the boiler surface; and for the purpose of allowing ample time to the heat to be absorbed by the tubes, the above space, together with the tube area, should be as large as possible. The arrangement must be so that the draught between the furnace and the chimney should be very slow, so that all the caloric, or nearly all, may be absorbed before the unconsumed gases are allowed to escape.

The boilers of the *Arctic* have 33 feet of heating surface for one foot of grate surface: this allowance is scarcely enough for hard coal—40 to 1 will not prove an excess. But this proportion depends, in a great measure, upon the velocity of the draught through the area which contains the tube or heating surface. The larger this space, or the longer its extent, the slower the motion of the gases will be; or the more extended their travel, consequently the longer they will remain in contact with the tubes. It is a very general defect in marine boilers, that the draught from the furnace to the chimney through the tube area, or through the flues, is nearly uniform, and too rapid. The "hanging- sheets" in the boilers of the Collins' steamers were designed to arrest this rapid flow, but they are not sufficient. The fact is, that the common plan of flue or tube boilers does not admit of a thorough application of the important principle in question; hence the necessity of a radical change.

Other questions of importance have to be considered in the planning of a marine boiler. Strength, facility of construction and repairs, provisions against unequal contractions and expansion, against incrustation, facility of blowing out and of cleaning, safety against exposure of heating surface when the ship is rolling or careening—all these are important points, but more or less understood. By the above remarks I have only attempted to direct attention to such points as are not generally understood, and consequently neglected. In a new plan of boilers which I have invented, all the essential conditions of perfect combustion, radiation, and absorption are fulfilled, and are calculated to produce much higher results than have been obtained heretofore.

In conclusion, I will yet remark that the subject of artificial draught is, in a great measure, an open question yet. The common fan-blast will answer very well under certain conditions; but in marine boilers, I am satisfied, exhaustion by proper mechanical means will work better. The control of large and connected fires can be better maintained by exhaustion than by blast, and also more economically.—*Scientific American.*

INCORPORATED BY ROYAL CHARTER.

CANADIAN INSTITUTE.

SESSION 1854-55.

First Ordinary Meeting—Saturday, December 2d, 1854.

The names of the following candidates for membership were read:—

Charles Fitzgibbon	Toronto.
Richard Forneri.	"
Arthur A. Farmer	Woodstock.
Lawrence Laurason	London.
John T. Newton, M.D	Sault Ste. Marie.
Hector Cameron	Toronto.
Rev. W. Leach, LL.D	Montreal.
W. Kingston, M.D	"
Alex. Rennie	"
Andrew Dickson	Packenham.
Hewith Bernard	Barrie.

A communication from the Council was read, being the "Report of the Special Committee appointed to consider Major Lachlan's suggestions with respect to the establishment of a series of Meteorological and other Observations throughout British North America."

REPORT.

The Committee appointed to consider Major Lachlan's suggestions with respect to the establishment of a series of simultaneous Meteorological observations throughout the British American Provinces, beg leave to report, that after giving due consideration to the plan suggested by Major Lachlan, they have thought it advisable, before recommending any special steps to be taken, that correct information should be procured with reference to the working of a similar system in the United States, which has now been in operation for some years. The Committee have requested one of their members to communicate with Professor Henry, the Secretary of the Smithsonian Institution, as well as with other gentlemen in the United States and Canada, whose views on this subject the Committee consider it essential to obtain. Not having yet received the required information, the Committee are unprepared to recommend to the Council any definite course of action.

The following gentlemen, who had been provisionally elected by the Council during the recess, were duly elected:—

J. C. Small	Collingwood Harbour.
Rev. Professor J. M. Smith	Kingston.
Rev. Professor J. Williamson	"
H. N. Courtlandt	Simcoe.
R. L. Denison	Toronto.
George Wilson	New York.
D. O. French	Toronto.
D. B. Read	"
John Thomson	"
Rev. Professor G. Weir	Kingston.
Rev. J. H. McKerras	Darlington.
Rev. W. Reid	Toronto.
John Moore	"
Rev. J. Gray	Orillia.
George Thomas	Chatham.
William Campbell	Quebec.
William C. Chewett, M.D	Toronto.

Notice was given by Professor Hind, that at the annual meeting of the Institute he would move for an alteration in the Bye-law relating to the day of meeting.

Notice was given by A. H. Armour, that at the annual meeting of the Institute he would move for an alteration in paragraph No. 2 of section 5 of the Regulations of the Institute.

Mr. Cowing submitted and described at length, his plans of a new Steam Plough and Portable Steam Engine for general purposes.

The thanks of the meeting were given to Mr. Cowing.

Second Ordinary Meeting—Saturday, December 9th, 1854.

The names of the following candidates for membership were read:—

John Page	Quebec.
James Browne	Toronto.
Philip Browne	"

The following gentlemen were elected members:—

Charles Fitzgibbon	Toronto.
Richard Forneri	"
Arthur A. Farmer	Woodstock.
Lawrence Laurason	London.
John T. Newton, M.D	Sault Ste. Marie.
Hector Cameron	Toronto.
Rev. W. Leach, LL.D	Montreal.
W. Kingston, M.D	"
Alex. Rennie	"
Andrew Dickson	Packenham.
Hewith Bernard	Barrie.

The following nominations of office-bearers for the ensuing year were made:—

President	The Hon. Sir John Boverly Robinson, Bart. The Hon. Mr. Justice Draper.
1st Vice-President	G. W. Allan. Professor Wilson.
2d Vice-President	Professor Wilson. G. W. Allan.
Corresponding Secretary	Thomas Henning.
Recording Secretary	F. W. Cumberland. D. Crawford.
Treasurer	D. Crawford. J. Stevenson.
Librarian	Sandford Fleming.
Curator	Professor Chapman.

MEMBERS OF COUNCIL.

Professor Croft.	Professor Hind.	A. H. Armour.
O. Mowat.	Prof. Cherriman.	Prof. Hincks.
Samuel Spreule.	A. Brunel.	Rebert Spratt.
Prof. Buckland.	J. T. Brondgeest.	S. P. Harman.
Prof. Bovell.	J. G. Hodgins.	G. P. Ure.

Annual General Meeting—Saturday, December 17th, 1854.

The names of the following candidates for membership were read:—

W. M. Jamieson	Toronto.
Henry Turner, M.D	Galt.
Ed. Clarke, M.R.C.S	Toronto.
John Holland	"

The following gentlemen were elected members:—

John Page	Quebec.
James Browne	Toronto.
Philip Browne	"

The Annual Report of the Council was read by the Secretary:—

ANNUAL REPORT OF THE COUNCIL, 1854.

The Council of the Canadian Institute have the honour to present their Third Annual Report since the grant of a Royal Charter of Incorporation at the close of the year 1851, and their Sixth Report since the establishment of the Society in 1849.

The Council consider the present a suitable occasion to review the progress of the Society during the short period which has elapsed since it acquired the position and privileges of a Chartered Institution.

At the close of the first year of Incorporation, the number of members of the Institute was 112. During the second year 135 new members were added, making a total at the close of the second year of 247. A similar encouraging increase has taken place during the past year, and the Council have now to report 333 names on their books. This number includes 18 members elected provisionally during the recess. The table subjoined furnishes a classification of the members of the Society in the orders acknowledged by the Institute.

Honorary Members	4
Life Members	10
Ordinary Members	288
Junior Members	31
Total	333

During the Session of 1853-4, the following papers were read at the ordinary meetings:—

J. T. Brondgeest — "On the Preservation of Food," 10th December, 1853.

Dr. Bovell—"Renal Circulation," 7th January, 1854.

A. Brunel—"On the Comparative Advantages of Single and Double Track Railways," 14th January, 1854.

G. H. Dartnell — "Duration and Expectation of Life in Canada," 21st January, 1854.

W. E. Logan—"On the Physical Structure of the Western District of Upper Canada," read by Prof. Croft, 18th January, 1854.

T. Henning—"Meteors and Falling Stars," 4th February, 1854.

Prof. D. Wilson, LL.D.—"Some Coincidences between the Primitive Antiquities of the Old and New World," 11th February, 1854.

Prof. Cherriman—"Meteorological Report, 1853," 11th February, 1854.

Rev. Prof. Irving—"On Solar Eclipses," February 18th, 1854.

Rev. Prof. Parry—"On the Early History of Rome," February 25th, 1854.

Prof. Chapman—"A Short Account of the Chlorastrolite of Lake Superior, and Observations on Minerals presented by Dr. Wilson, of Perth," February 25th, 1854.

Thomas Cottle—"A few rough Notes on some of the Saturniæ, and Suggestions on the Possibility of using their Silk for Textile Fabrics," read by Prof. Croft, March 4th, 1854.

Dr. Bovell—"On the reproduction of the Digestive Organs of the Holothurea, March 4th, 1854.

Dr. W. Craigie—"A List of Indigenous plants found in the neighbourhood of Hamilton, with the dates of their flowering." (*Laid on the Table.*)

E. Billings—"On some new Genera and Species of Cystidea, from the Trenton Lime-stone," read by Prof. Hind, March 11th, 1854.

Prof. D. Wilson, LL.D.—"On Traces of the Practice of the Medical Art amongst the early Romans," March 11th, 1854.

Major Lachlan—"On the Establishment of a System of Simultaneous Meteorological Observations, &c., throughout the British American Provinces," read by the Rev. Prof. Irving, March 18th, 1854.

Rev. Prof. Hincks—"Remarks on a Peculiar Vegetable Production from South America," March 18th, 1854.

Rev. Dr. Scadding—"Memoranda of Vesuvius and its neighbourhood," March 25th, 1854.

Prof. Chapman—"Remarks on the Tooth of an Elephas Primigenius, found in the River Credit," March 25th, 1853.

Prof. D. Wilson, LL.D.—"On the Intrusion of the Germanic Races into the area of the older Keltic races of Europe," April 1st, 1854.

E. Billings—"On some new Genera and Species of Cystidea, from the Trenton Limestone," read by Prof. Hind, April 8th, 1854.

Rev. J. McCaul, LL.D.—"On some doubtful Points in Grecian and Roman Antiquities," April 29th, 1854.

Major Lachlan—"On the rise and fall of the Great Lakes," read by the Rev. Prof. Irving, April 29th, 1854.

The Council have particular pleasure in acknowledging the great merit of several original papers contained in the foregoing list. The valuable contribution of W. E. Logan, F.R.S., "On the Physical Structure of the Western District of Upper Canada," is a very important addition to our knowledge of Canadian Geology, and seems to dispose of the question frequently raised respecting the existence of workable coal fields in Upper Canada.

The papers communicated by Mr. Elkanah Billings, "On some New Genera and Species of Cystidea from the Trenton Limestone," would do credit to the transactions of the most distinguished Societies in Europe and America. The highly interesting collection of facts, "On the rise and fall of the Great Lakes," by Major Lachlan, furnishes a large amount of instructive information respecting the history of one of those remarkable inland seas, and in the absence of any extended systematic observations, is a happy response to the wishes expressed in the Report for the year 1852. It is, however, a matter of sincere regret, that the present Council have to repeat the strong expression of disappointment contained in the Report of their predecessors, at the absence, with one exception,* of any papers on the Science of Engineering. The Council consider this is particularly to be regretted during the present period, when works of stupendous magnitude and vital importance are being executed throughout Canada.

* Mr. Brunel, "On the Comparative Advantages of Single and Double Track Railways."

The Council have much pleasure in being able to give assurance o the continued success of the *Canadian Journal*. It now serves as the medium through which the simultaneous Meteorological observations made at Toronto, Montreal, and Quebec, are presented to the public in a connected form. At the request of the Literary and Historical Society of Quebec, a limited portion of its pages is devoted to the gratuitous publication of a Synopsis of their Proceedings at their literary meetings. It is thought probable that other Canadian Scientific Societies will make application for similar privileges, and the Council would recommend to their successors the propriety of continuing a liberality which cannot fail to be generally advantageous to the advancement of Literature and Science in this country.

The circulation of the *Journal* is steadily improving, and now amounts to 554 copies monthly. In this number is included 60 copies, distributed by order of the Library Committee of the Legislative Assembly—an encouraging liberality, which the Council desires to acknowledge in the warmest terms.

The Council have not been unmindful of the interests of the Library in their expenditure of the funds entrusted to their charge. They have expended the sum of £69. 19s. 2d. for Books and Maps, but have been deterred from making other purchases in consequence of the anticipated amalgamation of the Athenæum with the Canadian Institute, —the valuable and extensive Library of that Society becoming the property of the Institute after the necessary Parliamentary sanction to the union has been obtained, which will probably be received early in the ensuing Session. The following list comprises the works which have been added to the Library by purchase:—

Books Purchased for the Library.

	Vols.
Ure's Dictionary of Arts	2
Geological Observer (De la Beche)	1
Notes and Queries	2
Lyell's Manual of Elementary Geology	1
Progress of Astronomy (Leoni's)	1
British Almanac, 1854	1
Humboldt's Views of Nature	1
Mantell's Fossils	1
Report of British Association, 1852	1
Nicholl's Architecture of the Heavens	1
Art Journal, 1852	1
Notes and Queries	6
Tredgold on Steam Engine—Marine Engine, Text, 1, plates 1; Stationary Engines, Marine Engines and Boilers, 1; Locomotive Engines, 1	4
Silliman's American Journal	16
Registrar General's Reports, from 1 to 15, with appendices.	18
	Nos.
Philosophical Magazine and Journal, 1854	10
Journal of Microscopic Science	8
Repository of Arts, Science and Manufacture	9
Quarterly Journal of the Geological Society	3
Quarterly Journal of the Highland Agricultural Society	3
Quarterly Journal of the Chemical Society	3
Chemical Gazette, 1854	17
	Vols.
Liebeg and Kopp's Annual Reports — Chemistry and Allied Sciences	4
Kirby and Spence's Entomology	2
General Structure of Animal Kingdom—T. Rymer Jones	1

Maps.

Bouchette's Map of Canada	1

The Periodicals mentioned in the former Report have been continued.

The Council are desirous of acknowledging the liberality of numerous gentlemen in Canada and elsewhere, whose contributions to the Library and Museum are rapidly creating most valuable and interesting adjuncts to the Society. The list subjoined contains the donations which have been received during the year :—

Donations.

	Vols.	
Norway and its Scenery, by T. Forrester	1	A. H. Armour, from Mr. Bohn.
Bechstein's Cage Birds	1	
China, Ava, and Siam, by Miss Corma	1	
DeLolme on the Constitution	1	
Egypt, Ethiopia, &c., by Lepsius	1	
Humphrey's Coin Collection	2	
Humboldt's Travels, Vol. III	1	
Introduction to History, 19th Century	1	
Logan's Geological Survey, 1845-46, & 1848-49,	2	A. H. Armour.
Do. do. 1846-47	1	Prof. Croft.
Do. do., North shore of Lake Huron, 1848	1	
Reports — Sea and River Fisheries of New Brunswick, 1852	1	Thos. Henning.
Do. Standing Committee on Railroads, 1852, (Canada)	1	
Do. Sums paid and Correspondence relative to Railroads, 1853, do	1	
Geological Survey of Canada, 1851-52	1	
Report of Special Committee on Magdalene Islands, &c., 1853	1	
Catalogue of Ancient and Modern Books	1	
Beckmann's History of Inventions, Vol. I.	1	A. H. Armour, from Mr. Bohn.
Do. do. Vol. II.	1	
Mathew of Westminster's Chronicles, Vol. I.	1	
Do. do, Vol. II.	1	
Alfred the Great, &c., by B. Thorp	1	
Henry of Huntingdon's Chronicles	1	
Humboldt's Travels, Vol. I	1	
Lectures on Painting, by the R. Academicians	1	
Geology of Scripture, Pye Smith	1	
Richardson's Geology, &c	1	
Humboldt's Cosmos, Vol. II	1	
Euclid's Elements, 1651,	1	Peter Cameron.
Comte's Philosophy of the Sciences	1	A. H. Armour, from Mr. Bohn.
History of England and Normandy, Vol. I., by T. Forrester	1	
Smith's Canada, Vols. I. and II	2	Thos. Maclear.
Culture of the Grape in United States, by C. Cist	1	A. H. Armour.
Cincinnati in 1851, by do	1	
Plans accompanying Report on a Railway Suspension Bridge over the St. Lawrence, near Quebec	2	R. L. O'Brien.
Magnetical and Meteorological Observations made at the Hon. East India Company's Observatory, year 1850	1	Hon. East India Company.
Transactions of the Royal Society of Edinburgh, Vol. XX., Part II., Session 1850-51	1	From the Societies.
Do. Vol. XX., Part IV., Session 1852-53	1	
Progress of do., 1850-51, Vol. III., 68th Session, from 2d December, 1850	1	
Do. 3d. March, 1851	1	
Do. Vol. III., 1852-53	1	
Contents of Vol. II., Dec., 1844 to April, 1850.	1	
Documentary History of New York, by Dr. O'Callaghan	4	A. H. Armour.
Hunt's Poetry of Science	1	A. H. Armour, from Mr. Bohn.
Mantell's Geological Excursions, Isle of Wight	1	
Gibbon's Rome, Vol. II	1	
Do. Vol. III	1	
Addison's Works, by Hurd, Vol. II	1	
Do. Vol. III	1	
Cowper's Works, Southey, Vol. II	1	
Do, Vol. III	1	
Naples under Spanish Dominion	1	A. H. Armour, from Mr. Bohn.
Condè's History of Arabs in Spain, Vol. I.	1	
Locke's Philosophical Works, Vol. I	1	
Athenæus Lit. translated, Vols. I., II., III	3	
Plato, translated by Burges, Vol. IV	1	
Catulus Fabulus	1	
Tacitus, Oxford Translation, Vol. II	1	
History of England and Normandy, Vol. II	1	
Ingulph's Chronicle	1	
Theorodet and Evagrius	1	
Mudie's British Birds, Vols. I. and II	2	
Dante, by Wright, illustrated by Flaxman	1	
Tasso, by Wiffin, 32 Plates	1	
Journal of the Royal Geographical Society, with Maps, Vol. 23	1	From the Societies, per H. Rowsell.
General Index to Second Ten Volumes	1	
Quarterly Journal of the Geological Society, Nov. 1, 1853, Vol. IX., P. 4, No. 36	1	
Do., February 1, 1854, Vol. X., P. 1, No. 37	1	
Statistics of the United States Census, 1850, 1022 pages	1	Hon. J. Brodhead, per A. H. Armour.
History, Condition, and Position of the Indian Tribes of the United States, Parts 1, 3, and 4, by H. R. Schoolcraft, LL.D., illustrated	3	
Patent Office Report, Part 1, 1853, Mechanics.	1	
Report of the Superintendent of the United States Coast Survey, 1852	1	
The Britannia and Conway Tubular Bridges. E. Clark, Vols. I. and II., 1850	2	R. Stephenson, per Sir C. Roney.
Plates to do	1	
Annual Report of O. S. and H. Railway	1	Directors.
Narrative of Failure to Establish a Military Asylum, &c., by Major Lachlan	1	Major Lachlan.
Trade and Navigation of the Province of Canada, 1853, Parliamentary Return	1	Hon. W. B. Robinson, M.P.P.
Geological Report of Canada, 1852-53	1	
Hayes' Book of British Birds	1	Mr. Hope.
Trade and Navigation Reports, 1850 and 1851.	2	Hon. W. B. Robinson, M.P.P.

Maps.

British Provinces of North America, 1776	1	Capt. Lefroy.

Museum.

Geological Specimens from Lakes Huron & Simcoe	Capt. Walker.
Minerals and Fossils from Ireland, Isle of Man, and Canada	T. W. Herrick.
Indian Relics	Dr. Richardson
Conch Shell from Fishing Island, Lake Huron	S. Fleming.
Mineral resembling Coal, from the Island of Barbadoes, and some Minerals from a Tar Spring in same Island	Dr. Bovell.
Ornithorhyncus from Australia	M. S. Baldwin.
Numerous Indian Remains—Specimens of Fossils and Mineralogy	Rev. G. Bell.
Bituminous Shale from Scotland, and two small Bottles containing Ashes	Prof. Chapman.
Geological and Mineral Specimens from Sault Ste. Marie	A. Mackintosh.

Building Site for the Canadian Institute.

Lot for Building on George Street	G. W. Allan.

The Council have to call the attention of the Institute to their tenure of the present commodious rooms they now occupy, with the consent of the Government. The probability of their being required for other purposes, demands the early attention of their successors. As yet no steps have been taken to acquire a permanent abode for the property of the Institute, or for their ordinary meetings, in case of a sudden removal being necessary. The Council, however, are enabled with much satisfaction to state, that the subject of a building has been divested of much pecuniary difficulty through the generosity of one of their members. The Institute is already aware of the munificent gift

by G. W. Allan, Esq., of the necessary ground, situated on George Street, as a site for a permanent building, and the Council beg leave to call the early attention of their successors to this important subject.

The Council have much pleasure in presenting their financial statement for the past year. The prospects of the Society in this important particular are very encouraging, and the subjoined sheet exhibits a balance in favour of the Institute of £343 6s. 10d. In this estimate the usual annual grant of £250 for the current year is included, but not that of £100, hitherto received by the Toronto Athæneum, and which with other sources of income of that Society, will be transferred to the Institute, upon the completion of the arrangements for the amalgamation of both Societies.

FINANCIAL STATEMENT FOR THE YEAR ENDING 30TH NOVEMBER, 1854.

Dr.	£	*s.*	*d.*
To Cash paid on Account of Publication of Journal	289	1	8
Sundries on Account of Institute	80	11	1
Library Expenses	69	19	2
To Balance due Maclear on Account of Journal	35	1	2
" " Scobie's Estate " do.	53	14	4
" " A. H. Armour " Library	29	8	9
" " Ogilvie	2	3	9
" " Cumings & Wells	0	18	6
" " Beckett & Co.	0	4	3
" " Reader for Journal	5	0	0
" " Assistant Secretary's Salary	12	0	0
Balance	343	6	10
	£921	9	6

Cr.		£	*s.*	*d.*
Balance from year 1853		191	17	0
By Cash for Sale of Journal	£47 0 0	308	11	3
" from Members	261 11 3			
" from Harbor Commissioners		25	0	0
" due on Account of Journal	£31 10 0	119	17	6
" Arrears of Members	87 17 6			
" due for Nos. of Vol. III. delivered		26	13	9
" Government Grant		250	0	0
		£921	9	6

The Report was adopted unanimously.

The following donations were announced:—

From A. H. Armour—The Census of Canada for 1851-52; also a Volume of Scientific Tracts.

From Capt. J. H. Lefroy, R.A.—Hand-Book for Field Service, by Captain J. H. Lefroy, R.A.

The thanks of the Institute were ordered to be given to those gentlemen for their respective donations.

A motion to change the day of meeting from Saturday to Tuesday, with a view to accommodate non-resident members, was brought forward by Professor Hind.

Resolved—That the present day of meeting be retained.

A motion to introduce certain alterations in paragraph No. 2, section 5, of the Regulations of the Institute, with a view to introduce uniformity in the financial year of the Institute and of the *Journal*, was brought forward by Mr. Armour.

Resolved—That Mr. Armour's suggestions be referred to the Council.

The votes for office-bearers and members of Council were collected, and Messrs. Thomas Ridout and T. J. Robertson appointed Scrutineers by the Chairman.

Prof. Bovell read a paper "On some specimens obtained from Rice Lake and the Humber River," illustrating his descriptions with microscopical preparations of the specimens of animal and vegetable life which formed the subject of the paper.

Prof. Bovell also made some remarks upon the "Respiratory Organs of the Lobster," and "Some peculiarities in the æsophagus of the Bear." Injected specimens of parts of the different organs described were laid upon the table, together with a very beautiful *Plumatella* from Rice Lake.

The Scrutineers delivered their report to the Chairman, who announced the names of the following gentlemen as office-bearers and members of Council for the year 1855:

President:

The HON. SIR JOHN BEVERLY ROBINSON, BART.

First Vice-President—Professor D. WILSON, LL.D.

Second Vice-President—G. W. ALLAN.

Corresponding Secretary—T. HENNING. Secretary—F. W. CUMBERLAND.

Treasurer—J. STEVENSON. Curator—Professor E. J. CHAPMAN.

Librarian—SANDFORD FLEMING.

Members of Council:

Professor CROFT. Professor CHERRIMAN. Professor BOVELL.
Professor HIND. A. BRUNEL. S. B. HARMAN.

Alphabetical List of Members of the Canadian Institute.

Names.	*Residence.*	
Adamson, Rev. W. A., D.D.	Quebec, C.E.	
Allan, G. W.	Toronto, C.W.,	Moss Park.
Andrew, Professor W.	Montreal, C.E.	
Armour, A. H.	Toronto, C.W.,	Wellington St.
Armstrong, W.	" "	Queen "
Arnold, John	" "	Peter "
Badgley, Prof. F., M.D., ...	" "	Bay "
Baker, Hugh C.	Hamilton, "	
Baldwin, Hon. Robt.	Spadina, near Toronto, C.W.	
Baldwin, W. W.	Oakridges, C.W.	
Baldwin, Robt., Junr.	Spadina, near Toronto, C.W.	
Baldwin, W. A.	Mashquoteh, near Toronto, C. W.	
Baldwin, Maurice S.	Toronto, C.W.	Duke Street.
Barclay, Rev. J.	" "	Wellington St.
Barron, F. W.	" "	U. C. College.
Bartlett, Rev. T. H. M.	Kingston, "	
Battersby, Leslie	Toronto, "	
Beaven, J. F.	London, "	
Beaven, E. W.	Toronto, "	Trinity College.
Beard, Charles	Woodstock, "	
Becher, H. C. R.	London, "	
Bell, Rev. Andrew	L'Orignal, "	
Bell, Rev. George	Simcoe, "	
Bennett, H.	Toronto, "	
Bernard, L.	Barrie, "	
Bethune, Prof. N., M.D., ...	Toronto, "	Richmond St.
Billings, E.	Bytown, "	
Bird, James	Peterboro,' "	
Blackie, John	Danville, C.E.	
Black, James	Ayr, C.W.	
Blake, E. D.	Toronto, "	Bay Street.
Bleasdell, Rev. W.	Trenton, "	
Bogert, J. J.	Toronto, "	Trinity College.
Boomer, A. K.	" "	Bay Street.
Boulton, W. S.	" "	John Street.
Boulton, Hon. H. J.	" "	Wellington St.
Bovell, Prof. James, M.D., ...	" "	St. George's Sq.
Bristow, Arthur	Weston, "	
Brondgeest, J. T.	Toronto, "	Yorkville.

Names.	*Residence.*
Brown, Geo., (M.P.P.)	Toronto, C.W. Church Street.
Brown, James	" " Peter Street.
Brown, Philip	" " "
Browne, George	Montreal, C.E.
Brown, John	Thorold, C.W.
Browne, J. O.	Toronto, " York Street.
Brunel, Alfred	" " Bond "
Brunskill, Thos.	" " Shuter "
Buchan, David	" " Yorkville.
Buckland, Prof. G.	" " Park Lane.
Burke, J. N.	Stanfold, C.E.
Burnet, Rev. R.	Hamilton, C.W.
Burwell, Lewis	Brantford, "
Cameron, Peter	Toronto, "
Cameron, J. M. A.	" " Canada Co. Office.
Cameron, Hon. Malcolm	Port Sarnia, "
Cameron, John	Toronto, " Wellington Street.
Cameron, Hon. J. H.	" " The Meadows.
Cameron, Hector	" " Toronto Street.
Cameron, Col. K.	Beaverton, "
Campbell, Major T. E., C.B.	St. Hilaire, C.E.
Campbell, E. C.	Niagara, C.W.
Campbell, W.	Quebec, C.E.
Carruthers, F. F.	Toronto, C.W. Ann Street.
Cayley, F. M.	" "
Chapman, Prof. E.	" " Yorkville.
Cherriman, Prof. J. B.	" " Observatory.
Chewitt, W. C., M.D.	" " York Street.
Clarke, Dr. E.	" " Gen. Hospital.
Clark, John	Port Dalhousie, C.W.
Connor, Skeffington, L.L.D.	Toronto, C.W., Bay Street.
Copp, W. W.	" " Richmond Street.
Cortlandt, H. N.	Simcoe, Norfolk, C.W.
Cotton, James	Toronto, C.W., Church Street.
Craigie, Doctor W.	Hamilton, "
Crawford, D.	Toronto, " Jarvis Street.
Crease, Lieut., Royal Engineers	Quebec, C.E.
Croft, Prof. H.	Toronto, C.W., Yorkville.
Crombie, E. M.	" " George "
Crooks, Adam	Toronto, " King "
Cull, E. L.	" "
Cumberland, F. W.	" " Duke "
Dartnell, E. T.	Toronto, C.W., Peter Street.
Dartnell, G. H.	Toronto, C.W., Peter Street.
Davies, W. H. R.	Montreal, C.E.
Davies, H.	Toronto, C.W., Trinity College.
De Blaquiere, Hon. P. B.	Toronto, " Yorkville.
Dennis, J. S.	" " King Street.
Denison, R. L.	Toronto, " Dundas Street.
Deslandes, P. F. C.	New York, U.S.
Devine, Thomas	Quebec, C.E.
Dexter, Armory	Cobourg, C.W.
Dick, Captain T.	Toronto, " Queen St. West.
Dickson, Andrew	Pakenham, C.W.
Donaldson, Capt. W.	St. Catherines, C.W.
Draper, Hon. Justice	Toronto, C.W., York Street.
Drummond, A.	" " Gerrard Street.
Duggan, Geo. Junr.	" " Adelaide Street.
Duggan, John	" " Bay Street.
Ellis, J. E.	" " King Street.
Ellis, Joseph	" " Queen Street.
Ellis, John	" " King Street.
Ermatinger, James	Stoney Creek, C.W.
Esten, J. H.	Toronto, C.W., St. George's Sq.
Ewart, John, Junr.	" " Yonge Street.
Farley, James	St. Thomas, "
Farmer, A. A.	Woodstock, "
Ferrie, Robert (M.P.P.)	Doon, "
Fitzgerald, W. W.	Toronto, " Adelaide Street.
Fitzgerald, W. J.	" " Wellington St.
Fitzgibbon, C.	" " John Street.
Fleming, S.	" " Victoria Street.
Flesher, W. K.	Artimesia, "
Forneri, R.	Toronto, "
Forrest, J. W.	Hamilton, "
Fowler, Henry	Toronto, " Wellington St.
Freeland, Patrick	Toronto, C.W. Church Street.
French, D. O.	" " Bay Street.
Fripp, H. G. R.	" " Yonge Street.
Gibbard, William	Barrie, "
Gibb, Doctor G. D.	London, England.
Gibson, David	York Mills, C.W.
Good, James	Toronto, " Yonge Street.
Grahame, W. R.	" " Richmond St.
Grant, John	Whitby, "
Grasett, Rev. H. J.	Toronto, " Adelaide Street.
Gray, Rev. J.	Orillia, "
Gregory, T. C.	Windsor, "
Gzowski, C. S.	Toronto, " Elm Street.
Hagarty, J. H.	" " William Street.
Hale, W. D.	Port Stanley, "
Hallan, S. W.	Toronto, "
Hall, Dr. A.	Montreal, C.E.
Hall, James	Peterboro, C.W.
Hallowell, Dr. W.	Toronto, " Duke Street.
Hancock, E. C.	" " Jarvis Street.
Hanvey, Daniel	St. Thomas, "
Harman, S. B.	Toronto, C.W., St. George's Sqr.
Harrington, John	" " King Street.
Harrison, Hon. S. B.	" " Dundas Street.
Harington, T. D.	Quebec, C.E.
Harris, John F. J.	London, C.W.
Harris, T. D.	Toronto, C.W., Duke Street.
Hawkins, W.	" " King Street West.
Haycock, T. H.	Chippewa, "
Herrick, T. W.	London, "
Herrick, Doctor George	Toronto, " Church Street.
Henning, Thomas	" " Queen Street.
Heward, W. B.	" " Yorkville.
Heyden, L.	" "
Heyden, L., Junior	" "
Hind, Prof. H. Y.	" " Spadina Avenue.
Hincks, Hon. Francis	Quebec, C.E.
Hincks, Rev. Prof. W.	Toronto, C.W. Yorkville.
Hirschfilder, J.	" " "
Hodder, Prof. E. M.	Toronto, " Queen Street.
Hodgins, J. G.	" " Education Office.
Hodgins, Thos.	" " Education Office.
Holwell, W. A.	Quebec, C.E.
Holland, John	Toronto, C.W., King Street.
Holland, G. B.	" " "
Hood, Andrew	Dunnville, "
Houghton, E.	Port Stanley, C.W.
Howard, J. G.	Toronto, " King Street.
Howard, J. S.	" " Gerrard Street.
Hutcheson, John	" " Church St.
Jacques, John	" " Front Street.
Jamieson, W. M.	" " King Street.
Jarvis, C. H.	Hamilton, "
Jones, W.	Port Stanley, C.W.
Jones, E. R.	Chatham, "
Irving, Rev. Prof. G. C.	Toronto, " Trin. College.
Joseph, J. G.	" " King Street.
Keefer, Samuel	Montreal, C.E.
Keefer, Thomas	" "
Kingston, Dr. Wm.	" "
Lachlan, Major R.	" "
Langton, John, (M.P.P.)	Peterboro, C.W.
Lawson, Walter	Guelph, "
Lawrason, L.	London, "
Leach, Rev. Dr. W. T.	Montreal, C.E.
Lefroy, Capt. J. H., R. Artillery	Woolwich, England
Lewis, Rice	Toronto, C.W., King Street.
Logan, W. E. (F.R.S.)	Montreal, C.E.
Lowe, F. C.	Toronto, C.W., Wellington Street.
Macaulay, J. J.	" " Carlton Street.
Macdonell, D.	" " Yongo Street.
Mack, Doctor T.	St. Catherines, C.W.
Mackenzie, H. M.	Guelph, C.W.
Macklem, Doctor Thomas C.	Chippewa.
Macklem, S. S.	"
Maclear, Thomas	Toronto, C.W., King Street.

Names.	*Residence.*
Macmeekin, Rev. H.	
Major, John	Toronto, C.W., City Bank.
Masson, John	Hamilton, "
Mayer, S. D.	Toronto. " Adelaide Street.
Meredith, E. A.	Quebec, C.E.
Mitchell, John	Montreal, C.E.
Moberly, Walter	Toronto, C.W., Church Ttreet.
Moffatt, Lewis	" " Yonge Street.
Moore, John	" " East Market St.
Morrison, J. C., (M.P.P.)	" "
Mowat, O.	" " Church Street.
Murney, Edward H.	Belleville. "
Murray, H. W. M	Toronto, " John Street.
M'Callum, A.	" " Model School.
M'Callum, James, Jr.	Uxbridge, "
M'Caul, Rev. John, L.L.D.	Toronto, " Carlton Street.
M'Clary, William	London, "
M'Donald, Donald	Toronto, " Quecn Street.
M'Donell, Alex.	Hamilton, "
M'Gill, Hon. Pcter	Montreal, C.E.
M'Gregor, C. J.	Elora, C.W.
M'Kerras, Rev. J. H	Darlington, C.W.
M'Nab, John	Toronto, " Church Street.
M'Phillips, G.	Richmond Hill, C.W.
M'Quecn, Thos.	Goderich, C.W.
Netting, George	Toronto, " King Street.
Newton, Doctor J. S.	Sault St. Mary, U.S.
Nicol, Doctor W. B.	Toronto, C.W., Adelaide Street.
Noblc, Lieut. A., Rl. Artillery	Quebec, C.E.
Northcote, Henry	Toronto, C.W., King Street.
O'Brien, E. G.	" " Toronto Street.
O'Brien, W.	Barrie, "
O'Brien, L. R.	Toronto " Church Street.
Orchard, T. C.	" " Front Street.
Page, John	Quebec, C.E.
Palmer, E. J.	Toronto, C.W. King Street.
Pardey, W. H.	" " "
Parry, Rev. Prof. E., St. John	" " Trinity College.
Parkes, Vincent	Toronto, C.W., Adelaide Street.
Parr, Richard	Chatham, "
Passmore, F. F.	Toronto, " King Street.
Patrick, Alfred	" " John Street.
Pell, J. E.	" " King Street.
Perram, J.	Tecumseth "
Perkins, Frederick	Toronto, " Peter Street
Philbrick, Prof. C. J.	" " Yorkville,
Phillips, T. D.	" " Trinity College.
Pipcr, Hiram	" " Yonge Street.
Primrose, Doctor Francis	" " Wellington Street.
Prosser, T. C.	Bolton, Albion, C.W.
Pyper, W.	Toronto, C.W. Wellington Street.
Read, D. B.	" " Queen Street.
Reekie, James	Quebec, C.E.,
Reid, Rev. W.	Toronto, C.W., Front Street.
Rennie, Alex.	Montreal, C.E.,
Richardson, J. H., M.D.	Toronto, C.W., Bay Street.
Richards, Hon. Justice	" " Yonge Street.
Ridout, Thomas	" " Bay Street.
Ridout, G. P,.	" " King Street.
Ridont, Charles	" " Maria Street.
Ridout, Charles	Bank of Upper Canada, Quebec.
Robarts, T. P.	Toronto, C.W., William Strcet.
Roberts, D.	" "
Robertson, T. J.	" " Wellington Street.
Robins, S. P.	Brantford, "
Robinson, Hon. W. B. (M.P.P.)	Toronto, C.W., Duke Street.
Robinson, Hon. Sir J. B., Bart., Chief Justice,	" " Beverly House.
Robinson, W.	Norwich, "
Robinson, Christopher	Toronto, " Beverly House.
Robinson, J. Lukin	" " Peter Street.
Ross, James (M.P.P.)	Belleville "
Rothwell, Richard	Toronto, "
Rowsell, Henry	" " York Street.
Rubidge, F. P.	Quebec, C.E.,
Rutherfcrd, E. H.	Toronto, C.W., Bay Street.

Names.	*Residence*
Ruttan, Henry	Cobourg, C.W.
Ryerson, Rev. Doctor E.	Toronto, " Victoria Street.
Rykert, G. Z.	St. Catherines, C.W.
Rykert, A. E.	Toronto, " Trinity College.
Sabine, Col. E , R. Artillery	Woolwich, England.
Salter, A. P.	Chatham, C.W.
St. George, H. Q.	Oakridges, "
Sangster, John H.	Hamilton, "
Savigny, H. P.	Barrie, "
Scadding, Rev. Doctor H.	Toronto, " U. C. College.
Schofield, M. C.	Berlin, Waterloo., C.W.
Scholefield, C. K.	Toronto, C. W., King Strect.
Schreiber, Collingwood	" " Elmsley House.
Sears, S. B.	Chatham, "
Shanly, Walter	Toronto, " Wellington Street.
Shanly, Francis	" " Bay Street.
Shier, John	Whitby, "
Simons, T. M.	Hamilton, "
Simpson, A. W.	Cobourg, "
Sladden, W.	Toronto, " Church Street.
Small, Rev. J. W.	" " Queen Street.
Small, Jas. C.	" " Front Street.
Small, Dr. John	" " Duke Street.
Small, Jos. C.	Collingwood Harbour, C. W.
Smallwood, Doctor Charles	Isle Jesus, C. E.
Smith, William	Otterville, Oxford, C. W.
Smith, Rev. Prof. J. M.	Kingston, C. W. Queen's College.
Sootheran, G. H	Toronto, " Yorkville.
Spragge, Hon. J. G. (Vice Chan'r.)	" " Portland Strcet.
Spratt, Robert	" " Jarvis Street.
Spreull, Samuel	" " Yonge Street.
Stark, David	Montreal, C. E.
Stephenson, Robert (M.P.)	England.
Stevenson, James	Toronto, C. W. Bank of Montreal.
Stewart, G. A.	Port Hope. "
Stewart, Chas.	Toronto, "
Storm, W. G.	" "
Strathy, G. W.	" " Bond Street.
Street, R. P.	Gore Bank, Hamilton, C. W.
Street, T. C.	Niagara Falls.
Toronto, The Rt. Rev. Lord Bishop of	Toronto, C. W., Front Street.
Thibodo, A. J. (M.B)	Trenton, "
Thomas, W.	Toronto, " Church Street.
Thomas, C. P.	" " " "
Thomas, G.	Chatham, "
Thomson, E. W.	York Township, C. W.
Thomson, C. E.	Toronto, C. W., Trinity College.
Thomson, John	" " King Street.
Torney, Hugh	" "
Turncr, C. H.	England.
Turner, Loftus	Toronto, C. W.
Turner, H. (M.D.)	Galt, "
Unwin, Charles	Toronto, "
Ure, G. P.	" " Terauley Street.
Valentine, J. S.	Niagara, "
Vankoughnet, P. M.	Toronto, " Wellington Street.
Vidal, Alex.	Sarnia, "
Walsh, F. L.	Simcoe, "
Walsh, T. W.	" "
Walsh, Robt.	Lloydtown, C. W.
Walker, E. A.	Barrie, "
Weatherly, Capt.	Toronto, " Provincial In. Co,
Weir, Rev. Prof. G.	Kingston, " Queen's College.
Weller, W. H.	Cobourg, "
Wells, Robt.	Toronto, " Park Lane.
Wells, R. M.	" " King Street.
Whitney, F. A.	" " Toronto Street.
Whitney, J. W. G.	" " "
Whittemore, E. F.	" " Bay Street.
Whitwell, Rev R.	Philipsburg, C. E.
Widder, Fred'k.	Toronto, C. W. Lyndhurst.
Williamson, Rev. Prof. J.	Kingston, " Queen's College.
Wilkinson, J. A.	Sandwich, "
Wilkes, G. S.	Brantford, "
Wilson, Prof. D. LL.D	Toronto " Yorkville.
Wilson, George	New York.

Woodruff, S. D.	St. Catharines, C. W.
Workman, Dr. B.	Montreal, C.E.
Workman, Doctor Jos.	Toronto, C.W.
Worthington, Thomas	Wellington, P. E. District, C. W.
Worthington, John	Toronto, C. W., Temperance St.
Worts, J. G	" " Front Street.
Wright, James	" " City B'k. Church St.
Wyllie, G. B.	" " King Street.

HONORARY MEMBERS, 4.

Lefroy, Capt. J. H.; R.A., F.R.S.	Sabine, Col. E.; R.A., F.R.S., &c.
Logan, W. E.; F.R.S., and G.S.	Stephenson, Robert (M.P.)

LIFE MEMBERS, 9.

Cayley, F. M.	Hincks, Hon. F.
Cotton, James	Hutcheson, John
Duggan, George, Junr.	Parkes, Vincent
Duggan, John	Vankoughnet, P. M.
Herrick, Doctor G.	

JUNIOR MEMBERS.

Baldwin, Robert	Murney, E. H.
Baldwin, M. S.	Murray, H. W. M.
Battersby, Leslie	M'Gregor. C. J.
Beaven, T. F.	Northcote, Henry
Beaven, J. W.	Phillips, T. D.
Bogert, J. J.	Ridout, Charles
Crombie, E. M.	Ridout, Charles
Dartnell, G. H.	Rothwell, Richard
Davies, H.	Rykert, A. E.
Esten, J. H.	Simpson, A. W.
Fitzgerald, W. W.	Thomas, C. P.
Forneri, R.	Torney, Hugh
Hallan, S. W.	Turner, Loftus
Heyden, L. Junr.	Wells, R. M.
Macklem, S. S.	Wright, James
Mayer, S. D.	

Honorary Members	4
Life Members	9
Members	306
Junior Members	31
Total	350

JAMES JOHNSTON,
Assistant Secretary,
Canadian Institute.

Toronto, 31st December, 1854.

Extract from the Report of the Parliamentary Committee on the application of the Council of the Canadian Institute for encouragement in the publication of the Canadian Journal.

The joint Committee of the Legislative Council and the Legislative Assembly, for the management and direction of the Library of Parliament,

Beg leave to present a Third Report.

"The Council of the Canadian Institute have made application to the Committee for some pecuniary assistance in the publication of their Journal, which is a monthly periodical devoted to the diffusion of Scientific and Literary information, chiefly connected with the progress of Science and Art in this Province. It also serves as a medium for the publication of such papers of interest, on topics of Provincial concern, as may be read before the Institute, and is a record of the proceedings of that steadily improving and useful Society. By a recent arrangement, the proceedings of the Literary and Historical Society of Quebec, are also given in this Journal. Viewing it as a vehicle for the dissemination of accurate and practical knowledge on topics of great and increasing importance in this country, and as a means of collecting information regarding the mineral resources and manufacturing skill of Canada, which may tend to advance our interests abroad, the Committee have unanimously agreed to recommend that sixty copies of the Journal be subscribed for, from its commencement, and for the future, until further orders. These copies, they suggest, should be circulated, in the proportions of 36 in Upper Canada, and 24 in Lower Canada, among Mechanics' Institutes, Colleges and Schools, and they are now in correspondence with the Editor, in order to ascertain in what localities the circulation of the Journal could be increased so as best to forward the interests of the publication, and to meet the views of the Committee for the benefit of those to whom they would desire to have it sent. Having ascertained these particulars, and obtained the sanction of the House to their recommendation, they will direct the copies subscribed for to be dispatched direct from the office of the journal to their respective destinations"

Extract from the Third Report of the Joint Library Committee presented to the Legislative Assembly, and concurred in by that House, on Monday the 18th December, 1854, having been previously presented to the Legislative Council, and concurred in by that Honorable Body.

(Signed) ALPHEUS TODD,
Secretary Library Committee.

Scheme of distribution of the "Canadian Journal" by order of the Parliamentary Library Committee.

The Committee of the Library of Parliament being desirous that the distribution of sixty copies of the "Canadian Journal" placed at their disposal by the concurrence of the Legislature in the foregoing report, should not interfere with the present circulation of the Journal, and having ascertained from the Editor the names of those Institutions and Public Bodies who are either subscribers or receive the journal free, have decided upon the following scheme of distribution of thirty-six copies in Upper Canada, and twenty-four in Lower Canada.

Scheme of distribution of thirty-six copies of the "Canadian Journal" in Upper Canada:—

1	Mechanics' Institute	Kingston.
2	" "	Hamilton.
3	" "	Belleville.
4	" "	Brockville.
5	" "	Cobourg.
6	" "	Perth.
7	" "	Picton.
8	" "	Guelph.
9	" "	St. Thomas.
10	" "	Brantford.
11	" "	St. Catharines.
12	" "	Goderich.
13	" "	Whitby.
14	" "	Simcoe.
15	" "	County of Peel.
16	" "	Port Sarnia.
17	" "	Chatham.
18	" "	County of Halton.
19	" "	County of Ontario.
20	" "	Port Hope.
21	" "	Stratford.
12	" "	Peterborough.
23	" "	Renfrew.
24	" "	C. of Perth (Mitchell.)
25	" "	Berlin.
26	" "	Fonthill.
27	" "	Dundas.
28	" "	Oakville.
29	" "	Waterdown.
30	" "	Bytown.
31	" "	Huron (Lib'y. Asso'n.)
32	Saint Michael's College	Toronto.
33	Upper Canada College	Toronto.
34	Victoria College	Cobourg.
35	Queen's College	Kingston.
36	Regiopolis College	Kingston.

Scheme of Distribution of Twenty-four Copies of the "Canadian Journal" in Lower Canada:—

1.	Université Laval,	Quebec.
2.	MacGill College,	Montreal.
3.	Mechanics' Institute	Quebec.
4.	" "	Montreal.
5.	" "	Three Rivers.

6. Mechanics' Institute ....Berthier.
7. " " ....Iberville,
8. Nautical College................................Quebec.
9. Canadian Institute................................Quebec.
10. Canadian Institute................................Montreal,
11. National Institute................................Montreal.
12. Mechanics' Institute ....St. Hyacinthe.
13. " " ....Sorel.
14. Bishop's College,................................Lennoxville.
15. College at St. Hyacinthe.
16. Shefford Academy.
17. Stanstead Academy.
18. Sherbrook Academy.
19. St. Francis College.
20. College at Chambly.
21. Clareneeville Academy.
22. Huntingdon Academy.
23. Masson College at Terrebonne.
24. High School at Durham Village, County of Missisquoi.

Copies of the second volume of the *Canadian Journal*, together with the published numbers of the third volume, will be sent from the office of the Institute in conformity with the foregoing directions. We regret that in consequence of the edition of the first volume being exhausted, the very liberal and encouraging instructions of the Library Committee cannot be carried out *in extenso* at present. There are now upwards of one hundred applications for Volume I. in the office of the Institute.

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

Literary or Stated Meeting, Wednesday, 1st November.

Frederick Boxer was proposed as an Associate member.

A paper was read by Lieut. A. Noble, R.A., on the mean results of Meteorological Observations taken at Quebec during the winters of 1852 and 1853.

A paper was read by Lieut. Ashe, R.N., F.R.A.S., on the Construction of a raft for rescuing persons from sinking ships.

General Monthly Meeting, Wednesday, 8th November.

Frederick Boxer was elected an Associate Member of the Society.

Literary or Stated Meeting, Wednesday, 15th November.

Lieut. Ashe, R.N., F.R.A.S., exhibited a model of the species of raft which formed the subject of his communication to the Society on the 8th. instant.

The peculiarities of the proposed raft, are, 1st. Its simplicity, and consequent facility of construction. 2nd. Its component parts being intended to be used for other purposes on board ship, are always at hand when required.

Wm. Antrobus Holwell read a paper describing a new species of projectile invented by him.

A donation was announced of two specimens of paper money in use in the British North American Colonies of New York and Pennsylvania, dated 1758 and 1776 respectively, presented by Wm. Antrobus Holwell.

E. A. MEREDITH, Vice-President.

Emigration of 1854.—The annual report of the Commissioners of Emigration, recently published, shows that 313,749 persons landed in New York from foreign ports during the last year, being a considerable increase over the year 1853. Of the above number 166,723 came from Germany, 79,004 from Ireland, and 30,075 from England.

Professor Edward Forbes.

While the sympathies of Canadians, as members of the British empire, have been largely excited by the events in the East, which, amid her triumphs, involve the death of so many men whom England can ill afford to spare, we are startled by the loss of one no less distinguished among those who take the lead in the ranks of scientific enterprise. It would be unjust to the students of science in Canada to suppose that the name of Edward Forbes can be unfamiliar to them; though in this western province of the empire, his loss cannot be expected to excite that profound and mournful regret with which its announcement has been received by those whose daily intercourse with him enabled to appreciate, not only all he had already accomplished for science, but also all that was to be expected from him.

Edward Forbes was in his thirty-ninth year, to all appearance only on the threshold of maturity, and with his best years before him for the elaboration of his favourite pursuits; and yet he was already recognised as prominently distinguished among the naturalists of Europe, and one of the foremost in the ranks of British Palæontologists. The estimate of his contributions to geological science, consequent on the additions, his extensive knowledge, and fine powers of observation, in relation to extinct and recent zoology and botany, enabled him to make to the natural history of geology, was abundantly proved by his election, in 1852, to the Chair of the Geological Society of London. This honorary office, which, according to the wonted usage of scientific societies, pertained to some of the veteran savans who had grown grey in the service, was justly regarded as a peculiar and marked distinction, when conferred by such men as Lyell, De la Beche, Murchison, Sedgwick, and Owen, on one still little more than a youth, and who was never destined to attain his fortieth year.

Professor Forbes was the son of a banker at Douglas, in the Isle of Man, where his earlier years were spent, and his studies pursued, till he entered as a student of Edinburgh University in 1830. There it was his good fortune to form one of a little band of students, whose intellectual pastimes in those pleasant college days ripened, in later years, into substantial results. Among his contemporaries at College were Professor Goodsir, the distinguished physiologist, Professor J. Y. Simpson, well known on this continent as the discoverer of the anæsthetic properties of chloroform, Professor J. S. Blackie, the translator of Æschylus, Dr. George Wilson, the biographer of Cavendish, Dr. S. Brown, Dr. Lyon Playfair, Professor Day of St. Andrews, the Rev. John Cairns, Professor Bennet of Edinburgh, and others, whose subsequent contributions to science and literature have added a peculiar interest to the retrospect of those who can recall the associations of that period of student life at Edinburgh. The facilities which the Scottish capital affords to the student of science, not only by its educational institutions and peculiar social constitution—in some respects analogous to that of the English University towns—but also, still more, by its singular natural advantages, were promptly appreciated by Ed. Forbes; and he very early formed the desire of being able to take up his permanent residence there. In a notice of him, in one of the local journals, ascribed to his old friend and fellow-student, Professor Goodsir, it is remarked:—

"When beginning his studies in Edinburgh in 1830, Mr. Forbes had already made great advances in his favourite scientific pursuits, and to these attainments he added remarkable artistic powers, and literary acquirements of extraordinary extent in one so young. The earliest friend he made among his fellow students there, calling on him only a few days after his arrival, found his rooms occupied in every corner by geological, zoological, and botanical specimens already collected in the neighbourhood. From that time he entertained the opinion so strikingly expressed in his last introductory lecture, that no other city afforded so many advantages to the student of natural history as Edinburgh. From his various travels in Norway, Sweden,* Germany, and Algeria, all accomplished by him while a student, he ever returned to that city as to a home endeared to him by scientific as much as social considerations. On these returns, too, he was hailed with pleasure by a circle of scientific, literary, and artistic friends, in each of whose pursuits he took the thorough interest of a fellow student, while by all of them he was recognized as a centre of high intellect and benig-

* It may not, perhaps, be altogether superfluous to remind the readers of the *Canadian Journal* that the subject of the present memoir must not be confounded with another member of the Edinburgh scientific staff, Professor Jas. D. Forbes, whose recent work on the Glaciers of Norway has added to the reputation acquired by previous valuable works.

nant affections. While yet a student, he published his first work, 'Malacologia Monensis;' in this he described the mollusca of his native island—the Isle of Man. To the Edinburgh Student's Annual of 1840 he contributed a paper 'On the Association of Mollusca on the British Coasts, considered with reference to Pleistocene Geology.' And during his residence in Edinburgh in 1840-41, he wrote and published his work on 'British Starfishes.'"

The name of Edward Forbes is also associated with one of the popular institutions of Edinburgh, which has not been without its influence on modern literature. In the Philosophical Institution of that city—somewhat analogous to the Mechanics' Institutes of Canada, though there markedly distinguished from the School of Arts, which more fitly performs the functions of a People's College—Edward Forbes gave the first publicity to many of those principles and ideas, which he subsequently elaborated in his most valued contributions to science. Among his colleagues, as lecturers to the Philosophical Institution of Edinburgh at that time, were his fellow-students Mr. Goodsir, Dr. Wilson, and Dr. Samuel Brown, and a greater publicity has been given to other courses of lectures, such as those of Dr. Moir (Delta), Hugh Miller, Aytoun, Kingsley and Ruskin, by their subsequent issue, in form or substance, from the press.

In the year 1838, Sir Charles Fellows, when travelling in Asia Minor, explored the ancient province of Lycia, and made many interesting discoveries in relation to that country, of which, till then, our knowledge was almost exclusively limited to the mythic legends of Homer and the historical records of Herodotus. The report furnished by Sir Charles Fellows of his discoveries in that ancient site of Greek colonization led to a Government expedition being despatched to the Levant, among the fruits of which were the beautiful Lycian and Xanthian marbles, now in the British Museum. Mr. Edward Forbes was selected as Naturalist to this expedition, and as such was attached to H.M. surveying ship Beacon, which sailed for its destination in the spring of 1841.

He had, in consequence of this, an opportunity of exploring some of the most interesting and least known parts of Asia Minor, in company with the Rev. E. T. Daniell and Lieutenant Spratt. Mr. Daniell died of sickness brought on by the climate, and a similar illness attacked Mr. Forbes, the effects of which, there is reason to believe, he never entirely recovered from. Soon after his return, he published, jointly with Mr. Spratt, an account of the expedition. This work, "Spratt's and Forbes's Lycia," besides its contributions to natural history, detailed the discovery of many ancient Lycian and Greek cities. Mr. Forbes's appointment to the Chair of Botany in King's College, London, took place, unexpectedly by him, during his absence in the East, and not long after, he was appointed secretary and curator to the Geological Society of London. In this position his extended knowledge of recent vegetable and animal species, and his remarkable acquaintance with the laws of their distribution (particularly as regards invertebrate animals), became available for general palæontological research. Here, too, he was enabled to apply to geology that peculiar knowledge of the conditions of existence of species, which his continual operations with the dredge had disclosed to him. It is to him, indeed, that we owe the methodical use of the dredge as an instrument of research in natural history; to use his own words, "the dredge is an instrument as valuable to a naturalist as a thermometer to a natural philosopher." At his instance, the British Association appointed for several years a dredging committee, charged with the duty of completing our knowledge of marine animals, with a view to geological inquiry.

The British association for the advancement of science was a favourite field of labour. There he resumed his coöperation with some of the most distinguished among his old fellow-students, and entered into honorable rivalry with the veterans in his favourite pursuits. In the natural history and geological sections, it will be difficult indeed to find any to supply his place. "He was transferred from the curatorship of the geological society to the staff of Sir Henry de la Béche for the geological survey of Great Britain and Ireland, in which the palæontological department was specially committed to him. He co-operated with his colleagues in arranging the Museum of Economic Geology established by the government in London, and at the same time held the lectureship of natural history in the relation to geology in that institution. During his connection with the geological survey, besides necessary field operations, he made descriptions and superintended the drawing and engraving of numerous fossil species, and contributed many valuable memoirs on geological subjects. About the same time he also wrote, in conjunction with Mr. Hanley, the comprehensive and beautifully illustrated history of "British Mollusca," which, like his earlier but not less remarkable history of "British Starfishes," forms part of the valuable series of natural history works published by Van Voorst." The death of the veteran Professor Jamieson, who had filled the chair of natural history in the University of Edinburgh for upwards of half a century, left vacant the post which had been long looked forward to by the friends of Edward Forbes as peculiarily suited for him; and accordingly, by the unanimous voice of the patrons, he succeeded to a chair which seemed to promise the fulfilment of all the most cherished wishes of his life. It also transferred him to congenial duties precisely similar to those he had already so admirably fulfilled in connection with the English Geological Survey; the preliminary steps having just before been take for establishing the Scotish museum of economic geology at Edinburgh. At the same time he looked upon his removal from London as an escape from many harassing duties and claims that seriously encroached on his time, and he spoke to his intimate friends, as though he had for the first time succeeded to such congenial duties as promised to permit his reaping the fruits of all his earlier labours and studies. On his appointment to the Edinburgh chair of natural history he at once commenced its more immediate duties, and delivered a course of lectures to a crowded class-room during the summer term of the past year. Up to the time of his last illness he was dilligently engaged in organising plans for the extension of the University Museum of which he was keeper; while the last labours of his pen were employed in revising the elaborate paper, prepared to accompany the geological and palæontological maps for the new edition of Johnston's "Physical Atlas."

A recent number of the Athenæum, published on Saturday, November 18th, the very day of his death, reviewed the four parts of the Physical Atlas, specially noticing the map prepared by Professor Forbes to illustrate the distribution of marine life. This brief notice, thus issuing from the press at the very time when he to whom it referred was closing his eye on all earthly things, and the hand that had executed this, its last task, so well, was "forgetting its cunning," does justice to the work. The reviewer remarks:—"the map by Prof. E. Forbes is new to this edition; and contains an epitome of his researches on the distribution of marine animals on the surface of the earth. The illustrations are selected from the fishes, *Mollusca* and *Radiata*. The careful manner in which Prof. Forbes has worked out this subject, and the important results at which he has arrived, render it desirable that all other families of animals and plants should, if possible be illustrated in the same way."

Professor Edward Forbes was a man of remarkable energy and perseverance, as well as of singular and varied talent, and in private one of the most delightful companions. He drew with great ease and spirit, and also with considerable humour; as is shown in the comic tail pieces, appended to his "British Starfishes," all the illustrations of which are from his own pencil. His comic vein also found vent not unfrequently in verse, and it was a special treat when intimate friends were gathered together, not only to recall the humorous records in verse of "The Great Snowball Riot" of old college days, when the military had to be called out to quell the insubordination of the exhuberant students, but to coax from him some later effusion dedicated to the "wars of science," the strifes of the modern Caractacus in the "*Silurian Fields*," or the great battle of the "Dodo," once waged so fiercely in association sections.

These, however, were but the playful pastimes of genius, wherewith in genial intellectual scintillations, he showed the healthful vigour of his mind. Edward Forbes,—as his old friends alone can designate him—was pre-eminently a naturalist. His attention had never been exclusively directed to any one of the Natural Sciences. He was equally a botanist, a zoologist, and a geologist, from first to last.—With a remarkable eye and tact for the discrimination of species and the allocation of natural groups, he combined the utmost delicacy in the perception of Organic and Cosmical relations. He possessed that rare quality, so remarkable in the great masters of Natural History, Linnæus and Cuvier, the power of availing himself of the labours of his brethren—not, as is too often the case, by appropriating their acquisitions, but by associating them voluntarily in the common labour. Entirely destitute of jealousy in scientific matters, he rather erred in overrating than in underrating the services of his friends.—He was consequently as much beloved and confided in by his seniors in science as by the youngest naturalists of his acquaintance. We find him, accordingly, in the earlier period of his career, taking an active part in geological and zoological discussion and publication with his veteran predecessor in the Edinburgh Chair of Natural History and his other fellow-members of the Wernerian Society, at the same time that, along with his early teacher, Dr. Graham, the late Professor of Botany at Edinburgh, his friends Drs. Neill and Greville, and a group

of younger men of his own standing, he assisted, along with Dr. Balfour, the present Professor of Botany, in founding the Edinburgh Botanical Society.

With his varied tastes and acquirements, it may readily be believed that Edward Forbes possessed the most comprehensive intellectual sympathies. Hence the peculiar value of his labours in the wide field which Geology embraces; and hence, no less so, the keen sense of irreparable loss felt by those who have enjoyed his personal friendship, or have shared in the privileges of intellectual coöperation and rivalry. His private conversation was peculiarly varied and attractive, and as has been already hinted, when he unbent himself among his more intimate friends, he was the delight of the social circle. As a public speaker, he was graceful, lucid, and when the subject required, and admitted of it, eloquent, and rich in playful fancy.

Dr. Forbes' last illness manifested its earliest symptoms by a nervousness, altogether unusual in him, when he began his course of lectures for the present winter. When it assumed more formidable symptoms, he ascribed it to a return of the ague, which he had caught during his expedition to Lycia, and subsequent examination after his death confirmed the belief that the seeds of the disease which terminated his life were sown during that period, when he underwent much fatigue and exposure, in his ardent pursuit of the objects for which he had been despatched to that long-unknown region. His friend, Professor Goodsir, remarks, in reference to his death, when apparently on the threshold of a new course of more concentrated labours, and of correspondingly higher triumphs:—"His sudden death, while causing deepest sorrow to his many friends, will be deplored by all who can appreciate the additions already made to Natural History by his genius and acquirements, and the promise of what he might have accomplished had his life been prolonged. His friends, indeed, know well how irreparable is their loss; but it is more difficult to estimate the loss to science caused by the removal of one who, following like his predecessors, Walker and Jameson, in the footsteps of Linnæus, gave promise of raising the Science of Natural History to a height nowhere yet attained. The hope that his labours would issue in such an important result was entertained on solid grounds by those who knew him intimately from the commencement of his career, and were thoroughly acquainted, as well with his past labours, as with his plan of future work." This is but one expression of what all feel. Another fellow-student and attached friend thus speaks of him, in announcing his death to the writer of this brief notice:—"Edward Forbes was a man of genius, and united to it so much good sense, prudence, discretion, kindliness, gentleness, and geniality, that it is no wonder he was so very largely and widely honoured and loved. To myself his loss is in many respects irreparable. Short-sighted mortals that we are, he and I had been arranging extensive conjoint labours, and this is the end of it! With nearly every one there is the feeling that he is taken away, not from the evil to come, but from the good that was anticipated from his work."

His funeral, which took place on Thursday, Nov. 23rd., was attended by the magistrates of the city, the Professors and students of the University, and a large body of the citizens. He is laid at rest in the Dean Cemetery, a beautiful wooded retreat on the banks of the waters of Leith, in the neighbourhood of Edinburgh, where Lord Jeffrey, Lord Coburn, Professor Wilson, David Scott the painter, and others of greater and lesser note are interred.

Twenty-fourth Meeting of the British Association for the Advancement of Science.*

LIVERPOOL, SEPTEMBER, 1854.

On Some of the more recent Changes in the Area of the Irish Sea: by Rev. J. G. Cumming.

All the recent changes in the relative level of land and sea, indicated in the Isle of Man, appear to have extended to the surrounding coasts of Britain and Ireland. The period of the boulder clay was marked by a cold climate and the subsidence of the island and surrounding coasts to the extent of at least 1,600 feet;—and, during the re-elevation of the country, there was an interval, when the land was stationary at about fifteen feet above its present level. The sea-bed of the great drift gravel was then left dry, forming an extensive treeless plain, connecting the Isle of Man with the surrounding countries, England being at that time united to the Continent. This was the second elephantine period, in which the great Irish stag (*Cervus megaceros*) became an inhabitant of the Isle of Man, along with other animals whose remains are found in the fresh-water marls occupying basin-shaped depressions in the gravel plain. The marl basins and the plains themselves were afterwards covered with vegetation, and are still often occupied with beds of peat, containing forest trees; but, during the same period, the sea was quietly eating back its way into the terrace of drift gravel, until the Isle of Man became insulated and the further immigration of animals and plants was arrested. Cliffs of drift gravel occur on all the coasts of the island, sometimes capping the hard rocks, at others retiring a little distance inland. The form of the channel, and the greater waste of the pleistocene deposits in the south of the Isle of Man, show that the action of the sea was chiefly from the south; and its higher level is proved by the numerous water-worn caves, above the highest modern tides, along the whole southern and western shores. A still later change is indicated by the submerged forests, on many parts of the coast, which appear to have grown after the formation of the gravel terrace, during a temporary elevation, by which the bed of the Irish sea was once more laid dry. Whether the last subsidence took place during the historic period is a question yet to be determined.

On the Great Terrace of Erosion, in Scotland, and its Relative Date and Connexion with Glacial Phenomena: by Mr. R. Chambers.

This terrace is very conspicuous, at twenty to thirty feet above the sea, along the Frith of Clyde, the Islands of Bute and Arran and coast of Argyle, but is less remarkable on the east coast of Scotland. The shells found on it are all of recent species. On the west coast the hills generally slope smoothly to the present beach, broken only by the well-defined rectangular cut of the great terrace, which forms a level platform, seldom less than 100 feet wide, at the base of a vertical cliff, often forty feet high. The cliff is perforated by many caves, and sometimes rough with overhanging stones; whilst fantastic masses of harder rock occasionally rise up from the platform. This terrace is considered to indicate the sea's action during a much longer time than the present beach has existed, and to have been formed at a period of some comparative geological antiquity. On the north-west coast of Arran the ancient sea cliff is 50 to 100 feet high; and the opening of Glen Jorsa is filled to a considerable height with terraces of detritus. The lower part of the detritus is composed of blue clay and small half-worn boulders; over it is a bed of coarse gravel and then fine sand. Some of this detritus rests on the face of the cliff itself, showing its origin to have been posterior to the incising action of the sea, by which the terrace was formed. The surface of the drift is not less than 140 feet above the sea level, and it is considered to be the product of a glacier once filling Glen Jorsa. The coarse sand and gravel indicate periods at which the land occupied different levels and the sea penetrated more and more into the valley: a succession of events requiring a great length of time.

Further Observations on Glacial Phenomena in Scotland and the North of England: by Mr. R. Chambers.

The author referred to his former attempt to establish a distinction between an early general operation of ice over the surface of Scotland, by which the boulder clay was formed, and a more recent presence of valley glaciers in the chief mountain-systems, bearing as its monument a looser and coaser detritus, like the moraines of the Alps. The latter is supposed to have taken place without the presence of the sea; the former with the sea or with ice covering so large a surface as not to allow of drainage,—just as on the west coast of Northern Greenland, Dr. Rink has shown that continental ice of vast thickness is continually advancing from the interior to the coast, and thus breaking off in icebergs. Additional examples of true moraines, or sub-aerial glacial deposits, have been observed in two of the valleys of Ben Macdin, Aberdeenshire, where conspicuous terminal moraines occur at various stages; in Glen Dearg four of these occur, a mile or two apart,—the height of one of them is 130 feet, the bottom of the valley being about 1,700 feet above the sea. In the valley of the Dee, the lateral vale of Muick has also a remarkable series of moraines at a much lower level. In the Tay valley below Aberfeldy, not more than 300 feet above the sea, there is moraine matter; and near Garth Castle are some more recent terminal moraines of the same glacier. These and other examples show that glaciers have been wherever the mountains approach 3,000 feet. Another class of Scottish moraines is connected with shallow recesses of the more elevated mountains, being placed in front of them, as if masses of snow had gathered till an outward movement took place, carrying coarse detritus for a few hundred yards. One of these exists in Benmore Coigach, near Ullapool, and the moraines which confine Lochs Whorral and Brandy are of the same

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*From the London Athenæum.

class. Loch Skeen, Dumfriesshire, is formed by another such moraine, the hills being 2,600 feet high, and the lake probably 1,200 feet. In front of a similar recess to the westward are other lines and humps of detritus; but there is no lake, the water having escaped by a passage still as clearly defined as a gate in a wall. A similar recess-moraine occurs in the valley of Loch Ranza, Arran, 50 feet above the sea, a furlong in length, with an opening in the centre; the recess is occupied by a morass. In the Lake district of England the author had obtained additional evidence of glacial action in the Thirlmere valley, where it enters the cross valley below the pass of Dummailraise, which connects it with the Grasmere valley. There is a remarkable double ridge descending the hill side, about 30 feet high, its surface bristled with blocks, like the train of detritus of a glacier 300 or 400 feet deep, coming down the Thirlmere valley; further down are other heaps of detritus along with roundod and scratched rocks. The author's last observations on the two sets of glacial phenomena were made at the Scotch mountain Schiehallion, which rises from a base 1,100 feet above the sea to the height of 3,600 feet, and is composed of quartz rock. It is abrupt to the westward, and tails away to the east; the top of the ridge is thickly strewn with looso slabs. About half-way up, and above the lovel of Ferragon, the highest mountain to the eastward, there are examples of striated surfaces, aud others within a few hundred feet of the summit; the direction in both instances being W. 30 N., or the same as that of the mountain ridge. About 800 feet below the summit a block of granite was found, and other foreign blocks were noticed in several places. These appearances, and the humps of brown moraine detritus in the valley of the Tay, indicate sub-aerial glacial action; but at the pass called White Bridge, the summit-level east of Schiehallion, there is a deep bed of true boulder-clay with many worn and striated blocks; it lies out of the way of valley glaciers, and has escaped removal by their agency.

On Associations of Colour and Relations of Colour and Form in Plants: *by* Dr. G. Dickie.

The Professor remarked that relations in the form, structure, number and position of organs are familiar to every botanist: *a priori* it might have been inferred, that order prevails also iu the distribution of colours. This is not only the fact; there are, besides, obvious indications of a relation between the colour and form of certain organs. My attention was first directed to the subject in April, 1853, and tho facts here recorded wore demonstrated to scientific friends at that date. A brief account of the subject was communicated to the Belfast Natural History Society in October following. Certain associations of colour have, however, been known to artists who have cultivated the special department of flower painting: any relation between form and colour seems to havo escaped notice, and even erroneous views have been promulgated;—for instance, by Ruskin in his 'Lamps of Architecture.' The subject appears to have been very much—perhaps altogether—overlooked by the botanist. The presence of all the colours, red, yellow, blue, which form compound or white light, is a physical want of the organ of vision. Among tho lower tribes of plants, the Algæ may bo mentioned as remarkable examples of constantly associated colours. Such, in fact, is the foundation of Prof. Harvey's classification, who divides them into red, green, and olive. Among the red there are many which have a red-purple hue, and among the olive not a few which are yellow-green stand in the same relation. Among mosses we find the red or red-purple peristome associated with the green or yellow-green capsule, and the samo is true of their stems and leaves. In flowering plants the associations of certain colours are so numerous, that it is unnecessary in the summary to do more than meution a few examples. In the leaves of *Caladium pictum*, *Coleus Blumei*, and *Victoria Regia* we fiud red or red-purple associated with green or yellow-green. The same is true of the pitcher-like organs of Larraceniæ, Nepenthes, and Dischidia. In the flower similar associations of various kinds are commou. We need not expect to find iu a corolla or any other organ the primaries red and yellow, or blue and red, associated and in contact. Tho red has green, the yellow has purple, and the bluo has orange associated. Of the primaries, blue is rarest,—many cases so denominated being, in fact, red-purples. In the flower yellow predominates, hence tho very general diffusion of purplo of various degrees of intensity. Purplo being of such general occurreuce in the flower, wo can now understand why yellow is the most common colour of pollen: some exceptional cases seem to confirm this; in the turn-cap lily, for example, the red pollen is associated with tho green filaments. The colour of the flower may have its complement in that of other parts, as stem, leaf, &c. Sometimes tho associated colours are not visible at the same time. The inside of a ripo fig is red-purple, the outside yellow-green. Sometimes a yellow corolla is succeeded by a purple fruit. Direct exposure to light, although usually and in general correctly admitted to have a direct relation to intensity of colour in organisms, appears not to be necessary in every instance. The plant, however, must receive the light at some part or other, in order to produce that intensity of colour observed in the coats of seeds, in the interior of fruits, and in the tissues of subterranean organs. In conclusion—1. The primaries, red, yellow and blue, are generally to be seen in some part of the plant. 2. When a primary occurs in any part of the plant. its complement will usually be found in some other part, or at some period or other of the development of the plant. I have found, in not a few instances, in the animal kingdom similar associations of colour; birds, mollusca and radiata present many obvious examples. We may next examine the relation between colour and form; and the remarks are, for the present, confined to the flower. Law 1. In regular polypetalous and gamopetalous corollæ the colour is uniformly distributed. That is to say, the pieces of the corolla, being all uniform in size and shape, have each an equal proportion of colour. Examples of this occur in Primulaceæ, Boragineæ, Ericaceæ, Gentianeæ, Papaveraceæ, Cruciferæ, Rosaceæ, Cactaceæ, &c.—Law 2. Irregularity of corolla is associated with irregular distribution of colour. The odd lobe of the corolla in such is most varied in form, size and colour. Wheu there is only colour, it is usually more intense in the odd lobe. When there are two, one of them is very generally confined to the odd lobe. Sometimes, when only one colour is present, and of uniform intensity in all the pieces, the odd lobe has spots, or streaks, of white. The odd lobe, therefore, in irregular flowers, is distinguished from the others not merely by size, form, and position, bnt also by its colour. Papilionaceæ, Labiatæ, Scrophularineæ, &c., are examples. In some cases, as Gloxinia, Achimenes, Rhododendron, &c., in which irregularity of flower is less marked, the two pieces on each side of the odd lobe frequently partake of its character as regards colour. In some thalamifiorous Exogens (as Pelargonium, Tropæolum, Æsculus), &c., with irregularity of flower, owing chiefly to difference in the size of the pieces, the largest aro most highly coloured.—Law 3. Different forms of corolla in the same inflorescence often present differences of colour, but all of the same form have the same colour. The Compositæ are examples;—when there are two colours, the flowers of the centre have one colour and uniform in its intensity; those of the circumference also agree in this respect, but have the other colour. The first two laws prevail in monocotyledons as well as in dicotyledons. In the former the calyx and corolla generally resemble each other in structure, shape, and in colour also. The law of the contrasts is, therefore, simpler in monocotyledons than in dicotyledons. The former may be symbolized by the triangle, three and six being the typical numbers in the flower; the latter by the square or pentagon, four and eight, five or ten, being the prevalent numbers. Simplicity of figure corresponds with simple contrast of colour in the one, while greater complexity of colour and of structure are in direct relation in the other. According to the investigations of Brongniart, there has been progressive increase of angiospermous dicotyledons up to man's epoch. Among them we find the floral organs with greater prominence in size, form and colour, and such prominence of the "nuptial dress" of the plant is peculiarly a feature of species belonging to natural families which have found their maximum in man's epoch and are characteristic, of it.

Mr. Warrington gave an account of some experiments he had made on the influence of coloured glass on the growth of plants in sea-water. He found the red sea-plants grew best in glass-cases coloured green, and that green Confervæ were thus destroyed.—Mr. Huxley made some remarks on the general theory of harmony and adaptation in nature. He thought naturalists were too much disposed to take it for granted that beauty was an end in creation. He believed, on the contrary, that grotesqueness was frequently an object, and that iuharmonious and iuapposite colours and forms were purposely brought together, and thus excited the feeling of the ridiculous.—Dr. Carpenter called attention to the fact, that different chemical conditions of the plant produced chemical colours; and the point to be ascertained was whether these were subservient to the laws of harmony sought to be established.

On the Progress of Naval Architecture and Steam Navigation, including a Notice of the Large Ship of the Eastern Steam Navigation Company, by the President, Mr. Scott Russell.

Mr. Russell explained the principles which guide the construction of ships, and condemned the legislative restrictions which, till within the last twenty years, prevented the application of those principles. The old "sea chests," which were constructed with a view to avoid the taxa-

tion imposed on ships that were not built of certain shapes, possessed neither the requisite properties of stability nor winwardness, and were very slow; they were built solely with a view to hold the greatest amount of cargo within a given superficies, without regard to the other qualities of a ship. In smuggling and piratical vessels the true principle of ship building, for acquiring speed, had however been long introduced before the subject was taken up by the British Association, and the wave principle of construction had thus been established by extended experiments on a large scale. A fine concave entrance, instead of a bluff round bow, is now generally admitted to be the best; and, in addition to the shape of the water line, it had been found that length of the body of a ship facilitates its passage through the water, by allowiug a longer time for the particles of the fluid to separate. A ship with a fine concave bow, a long body, and a comparatively round stern, Mr. Russell said, cleaves its passage through the water without raising a wave in front to obstruct its course. No steam ship that is not 180 feet long can be propelled at a speed of sixteen miles an hour without a great expenditure of power; and 400 feet is the shortest length for a ship that is intended to be propelled at so high a speed at twenty-four miles an hour. As an illustration of this rule, it was mentioned that the Himalaya, which is 365 feet long, attains the greatest speed for the power employed of any merchant ship. In the construction of large ships, however, the builders were met with the difficulty of not being able to find wood of sufficient size for the requisite strength, since no means have yet been invented of joining pieces of wood together so as to give them the same strength as the whole timber This want of material of sufficient size was supplied by using iron, for the joints can be made as strongly as the whole plate, or plates of metal of any required size can be rolled for the purpose. This facility of increasing the size of the material is the principle advantage derived from the use of iron, which affords facilities for constructing ships of any size; and it is of that material that the great ship, now building in London for the Eastern Steam Navigation Company, is to be constructed. Mr. Russell complimented Mr. Brunel for the engineering skill and ingenuity he had displayed in leading the way in the construction of large iron ships; and he alluded to the forebodings of disaster on former occasions, when the Great Western and the Great Britain were built, which forebodings events had shown to be groundless; and he felt confident that the similar forebodings which some people had expressed of the still larger ship now being built would be equally fallacious. Mr. Russell said he wished it, however, to be understood that he did not recommend the general adoption of such large ships. The size of the ships ought to be suited to the traffic and the distance; but the point he contended for was, that it is only by employing very large ships that steam navigation to distant parts of the globe can be profitably carried on. A steam-ship to Australia, if it were not large enough to carry sufficient coal for the voyage, had to take in a supply over and over again, and at each station the cost of the coal was increased by conveying it to the different stations. Under such disadvantages no freight could pay the cost of conveyance; and in order to remove them, it was necessary to build a ship of sufficient size to carry a supply of fuel for the voyage out and back again, or equal to circumnavigating the globe. An extremely fine entrance was another of the characters which the large ship now building would possess, so as to enable it to move through the water with the greatest attainable velocity with a moderate amount of steam power. With these advantages it was expected that the ship would accomplish the voyage to Austraila in thirty or thirty-three days. It would easily carry six thousand tons, besides its requsite quantity of coal; and would have excellent accommodation for 500 first-class passengers, 600 second-class, and 1,000 third-class passengers. It would be 675 feet long, 83 feet in breadth of beam, and 60 feet deep; and though so large that St. George's Hall is small in comparison, it is the smallest size that could do the work required with speed and economy.

Mr. Fairbairn said Mr. Brunel had shown him the plans; and though he had at one time thought a ship of that size would be too large for strength, he had, after examination of the plans, arrived at the opposite opinion. He had now no doubt that the ship would be perfectly strong, and be able to bear a gale of wind without bending. It was built on the same principle as the Britannia Tubular Bridge; and when it was perceived that that mode of structure is able to sustain a bridge without any support in the middle, there could be no doubt that supported as the ship would be by the water, it would under all circumstances be able to bear the strains to which it might be subjected.

Mr. Nasmyth explained a plan for destroying ships by means of a marine mortar fixed at the bow of a strongly built vessel to be propelled by steam power; He proposed to place in the bow of the vessel, and projecting about two feet beyond it, a case large enough to contain about six hundred weight of gunpowder. A percussion ball was to be inserted at the back of the reservior of gunpowder to explode at the instant that it struck against the ship to be destroyed. The mortar vessel was to be built of blocks of timber, so strongly as to be able itself to resists the effects of the explosion, which would completely destroy the enemy's ship. Such a marine mortar, it was stated, could be amply manned by "three brave fellows," who would be secured from danger by the strength of the ship and its recoil, and by them occupying a position least exposed to injury, even should the explosion do damage to the parts nearest to it.

Mr. Nasmyth described a Lightning Conductor for Chimneys, which he conceived affords more perfect insulation, and is therefore safer then those in common use. The present practice is to fix the conducter outside the chimney by metal holdfasts, by which means during severe thunder-storms chimneys are often damaged by the lightning entering at the points of attachment and displacing the bricks. In the method of fixing the conducter recommended by Mr. Nasmyth the metal rod is suspended in the middle of the chimney by branching supports fixed on the top. A conducter of this kind had proved efficient in storms which had severely injured other chimneys in the neighbourhood that were protected in the usual manner. An experience of eighteen years had tested the superiority of the plan.

Prof. Faraday, on being called on for his opinion, said that he recommended that lightning conducters should be placed inside instead of outside of all buildings. He had been consulted on that point when the lightning conducter was fixed to the Duke of York's Pillar, and he advised the placing it inside, but his advice was not taken, and the rod was fixed outside, to the great disfigurement of the column. All attachments of metal to or near the conducter are bad, unless there be a continuous line of conduction to the ground. He mentioned the instance of damage done to a lighthouse in consequence of part of the discharge lightning having passed from the conducter to the lead fastening of the stones. The practical question for consideration by the Mechanical Section was, how far they could safely run lead between the stone of such a structure, for if it were done partially, leaving a discontinuous series of such metallic fastenings, there would be great danger of the stones being displaced by the electric discharge. When such fastenings are used, care should be taken that they are connected together and with the earth by a continuous metallic conducter. Some persons conceived that it is desirable to insulate the conducter from the wall of a building by glass, but all such contrivances are absurd, since the distance to which the metal could be removed from the wall by the interposed insulator was altogether insignificant compared with the distance through which the lightning must pass in a discharge from the clouds to the earth. On being asked whether a flat strip of copper was not better than a copper rod, Prof. Faraday said the shape of the conducter is immaterial, provided the substance and quality of the metal are the same.

A communication from Mr. Sewell, *on Boiler Explosions*, gave rise to a discussion on the causes of such explosions, and on the effect of percussion in weakening the strength of iron, in which Mr. Fairbairn, Mr. Roberts, Mr. Hopkinson, Mr. Oldham, and other members took part. Mr. Fairbairn said, that, so far as his experience went, the explosions of boilers generally occur at the moment the engines start; in consequence of the sudden generation of steam by the increased motion given to the water. With respect to the weakening of railway axles by use, he conceived that effect to be produced rather by the continuous bindings of the metal, however small they may be, which give a set to the fibres and increase the liability to break. Boiler-plates are also frequently injured by the operation of punching for melting. Mr. Roberts attributed boiler explosions in most instances to the defective construction. He was of opinion that in rivetting boiler plates the rivets are seldom made large enough, large rivets being much stronger than small ones.—Mr. Clay said the crystalline structure of wrought iron acquired by long continued percussion might be restored to the fibrous state by reheating. Mr. Oldham considered it would be of advantage to reheat the axeltrees of locomotive engines after they had run for some time, so that the fibrous structure, from whatever cause it was rendered crystalline, might be restored.—Mr. Roberts was not disposed to admit that any change is produced in the quality of iron by wear. If the iron were of good quality and perfect at first it would remain so till it was worn out. He observed that bars

of iron are frequently different at their opposite ends, for whilst one is tough the other may sometimes be broken with a slight stroke of the hammer.

Mr. W. Clay explained the construction and mode of fixing the large fly-wheel of the Warsey forge, which is the largest fly-wheel in the world. It is 35 feet in diameter, and 60 tons weight, and its axle is mounted on friction rollers.—Mr. Clay also produced and explained the model of a machine used for rolling taper iron, by which an iron bar may be rolled of any length and tapered to any required degree. The principle of the action of the machine consists in keeping one of the rollers fixed in its bearings by hydraulic pressure. A valve, regulated by a fine screw, permits the water to escape, and thus as the operation proceeds the rollers become more and more separated, and the iron bar less flattened. By regulating the valve, so as to allow of greater or less escape of the water, the degree of tapering can be very accurately adjusted.

Meteorological Observations, &c., on Lake Nipissing,

During the Months of October and November, 1854, by Alexander Murray, *Assistant Provincial Geologist.*

We are indebted to Alexander Murray, Esq., for the following abstracts from his Journal during a recent visit to Lake Nipissing. Although the observations do not extend over a period of more than twenty-seven days, yet they furnish some interesting glimpses of the nature of the autumnal climate of that remote and unfrequented lake. Lake Nipissing is 69 feet above Lake Huron, or 647 feet above the sea; Lake Superior being 597 feet, Lake Simcoe 706, and Balsam Lake—the highest in Western Canada—about 820 feet above the sea level. The influence of a northerly wind is well shown on the 4th of November, when the thermometer fell to 18 degrees at 7.30 p. m., and descended as low as 15 degrees at 8 p. m., the temperature at Toronto being at the same time 17.5°

1854.	Time.	An. Bar.	Ther. Att.	Ther. Det.	Temp. of water.	Remarks, Weather, &c.
			°	°	°	
Oct. 16	6.35 a. m.	28.750	42	44	—	Fresh gale from West.
"	1.00 p. m.	28.800	47	47	—	Do.
"	8.00 p. m.	28.850	43	45	—	
Oct. 17	7.00 a. m,	28.950	39	41	46	
"	6.00 p. m.	29.000	50.5	53	54	
"	6.30 p. m.	29.000	49	49	—	[blowing hard.
Oct. 18	7.00 a. m.	29.075	41	39	—	Snow with NE wind
"	2,00 p. m.	29.155	41	39	—	Do.
"	6.00 p. m.	29.225	41	38	—	Do.
Oct. 19	7.00 a. m.	29.375	44	37	—	Ice along the shores.
"	8.00 a. m.	29.400	38	40	—	[Ther. Att. affected
"	1.00 p. m.	29.500	40	43	44	[by local heat.
"	9.25 p. m.	29.325	41	43	—	
Oct. 20	8.00 a. m.	29.350	44	45	47	
"	0.30 p. m	29.375	48	50	—	
"	5.30 p. m.	29.475	51	52	—	
Oct. 21	7.00 a. m.	29.550	47	48	—	Cloudy and Calm.
"	9.00 a. m.	29.525	48	49	—	Do.
"	Noon.	29.500	56	55	51	Do.
"	5.30 p. m.	29.500	55	55	—	Do.
Oct. 22	8.00 a. m.	29.525	48	49	—	Cloudy, with a light
"	4.35 p. m.	29.455	54	55	—	Do. [breeze from SE.
"	7.00 p. m.	29.475	56	56	—	Do.
Oct. 23	7.00 a. m.	29.450	46	48	—	Cloudy, blowing fresh
"	6.00 p. m.	29.400	51	52	—	Do. [from SE.
Oct. 24	9.00 a. m.	29.450	52	51	—	
"	0.30 p. m.	29.500	56	55	54	
"	6.20 p. m.	29.525	56	56	—	
Oct. 25	8.30 a. m.	29.625	52	53	—	Calm and cloudy,
"	Noon.	29.650	59	62	53	Do.
"	9.00 p. m.	29.575	62	61	—	Light wind from WSW.
Oct. 26	7.30 a. m.	29.550	53	58	—	Light wind and cloudy.
"	6.00 p. m.	29.500	56	57	—	Fine—little wind.
"	9.00 p. m.	29.575	60	61	—	
Oct. 27	7.00 a. m.	29.455	47	49	—	Calm and clear.
"	1.00 p. m.	29.500	65	64	55	Very fine—calm.
"	6.30 p. m.	29.400	56		—	Light wind & very fine.
Oct. 28	6.40 a. m.	29.325	36	37	—	Calm & hazy—red sky.
"	11.30 a. m.	29.400	65	63	54	Calm and hazy —Halo
"	6.00 p. m.	29.400	58	60	—	Do. weather[round sun.
Oct. 29	7.40 a. m.	29.300	52	53	—	Calm and cloudy.
"	0.45 p. m.	29.250	55	62	—	Light wind E with rain.
"	8.30 p. m.	29.200	55	56	—	Light wind—star light.
Oct. 30	7.20 a. m.	29.225	53	55	—	Calm and cloudy.
"	1.00 p. m.	29.210	63	63	55.5	Light wind SE—driz. r.
"	6.00 p. m.	29.125	61	62	—	Light S wind & cloudy.
Oct. 31	7.00 a. m.	28.900	58	61	—	Calm and cloudy.
"	Noon.	28.775	60	62	—	Cloudy with showers.
"	7.00 p. m.	28.625	56	58	—	SW wind with rain.
Nov. 1	7.15 a. m.	28.800	42	44	—	W wind and cloudy.
"	1.00 p. m.	28.825	48	51	54	Cloudy—dist. thunder.
"	8.00 p. m.	28.875	41	43	—	W winds—passing sh.
Nov. 2	7.20 a. m.	28 925	34	36	—	Bright and calm.
"	Noon.					Fresh breeze & cloudy.
"	4.30 p. m.	28.725	42	46	—	Heavy rain and squals
"	9.00 p. m.	28.825				[from SW.
Nov. 3	7.00 a. m.	29.150	24	28	—	Snow showers.
"	2.00 p. m.	29.300	34	34	47	Fresh breeze N. of West.
"	8.00 p. m.	29.225	27	30	—	Snow sh.—clear interv.
Nov. 4	7.30 a. m.	29.450	18	19	—	Strong wind from N.
"	Noon.	29.575	31	29	48	Wind NW by W.
"	6.00 p. m.	29.500	19	20	—	
"	8.00 p. m.	29.500	15	18	—	Calm and clear.
Nov. 5	7.00 a. m.	29.425	15	18	—	Calm and cloudy.
"	7.30 a. m.	29.425	22	26	—	Snow.
"	Noon.	29.400	34	36	52	Below Chaudiere Falls.
"	9.00 p. m.	29.150	34	36	—	[25 feet fall from Lake
Nov. 6	8.00 a. m.	28.775	34	36	—	[Nipissing.
"	Noon.	28.550	40	40	—	Rain from SW.
"	2.00 p. m.	28.550	40		—	Heavy rain.
Nov. 7	7.30 a. m.	28.575	34		—	Cloudy with snow sh.
"	Noon.	28.775	44	46	52	Wind NW descending
"	7.00 p. m.	28.850	34	37	—	[French River.
Nov. 8	8.00 a. m.	29.000	28	31	—	Clear—West wind.
"	Noon.	29,100	41	37	51	Clear.
"	6.00 p. m.	29.500	31	34	—	[Huron.
Nov. 9	8.00 a. m.	29.275	23	23	—	Cloudy—North wind L.
"	Noon.	29.325	31	33	40	E wind and cloudy.
"	9.00 p. m.	29.200	26	31	—	
Nov. 10	6.00 a. m.	29.200	36	39	—	NE wind
"	Noon.	28.925	47	47	46	Fresh breeze with rain.
"	8.00 p. m.	28.775	48	50	—	Fresh SE wind with r.
Nov. 11	7.00 a. m.	28.850	43	45	—	Strong Westerly wind.

Climate of the Crimea.

The following tables show the temperature of the seasons at Sebastopol, London, Paris, Dijon, Toronto, Hamilton, and Kingston. They will serve to convey an idea of the climate of Sebastopol, now a subject of universal interest.

	Latitude.	Longitude.	Temperature of Winter, Fahrenheit.	Temperature of Spring, Fahrenheit.	Temperature of Summer, Fahrenheit,	Temperature of Autumn, Fahrenheit.	Temperature of Year, Fahrenheit.	Number of Years Observations.	Height above the Sea in Feet.
	° ′	° ′							
Sebastopol*	44 36	33 32	35.945	1.62	70.57	53.76	52.97	10	—
London . .	51 30	0 5	39.504	9.06	62.93	51,83	50.83	50	—
Paris . . .	48 50	2 20	37.855	0.62	64.58	52.20	51.31	39	114
Dijon . . .	47 19	5 2	35.385	3.30	69.58	53.30	52.89	7	700
Toronto . .	43 39	79 21	25. 04	0. 9	64. 6	46. 5	44.23	12	440
Kingston . .	44 8	76 32	18. 74	1. 7	67. 7	48. 7	44. 7		400 nearly.
Hamilton. .	——	——	23. 94	2. 8	64. 6	45. 9	44.25	8	400 nearly.

* Dove's Meteorological Tables.

The mean winter temperature at Toronto is 10°94 lower than at Sebastopol. The lowest mean temperature of any month in the winter at Sebastopol is 34°27, in January; at Toronto it is 24°2 for the mean of fourteen years, and 17° for the coldest month recorded, in 1840. At Dijon the lowest mean monthly temperature is 33°58, Paris 35°44. London, 37°35. From these facts there does not appear to be any cause for apprehension that our gallant troops in the Crimea will suffer from extreme cold.

Mineral Wealth of the Ottawa Region.

During the past week were shipped from Bytown a number of large specimens of ores, marbles, building stones, and other natural productions, destined to take a part in the great Exhibition of Industry of all Nations at Paris in May next. There was a huge mass of the magnetic iron ore contributed by J. Forsyth, Esq., from the mine in the township of Hull, weighing over two thousand pounds: another six feet long, and of about the same weight of specular iron, from the township of MacNab, from A. Dickson, Esq.; and a piece of silicate of iron, weighing about two hundred and sixty pounds. This latter is a rare mineral, and the specimen in question is perhaps the largest yet seen. Besides these, there were two strongly hooped casks, weighing over eighteen hundred pounds of other specimens of ore, and a number of boxes and uncovered blocks of limestone and marble. The object in procuring such large masses is to enable the Parisians to form some conception of the extent of the supply by the magnitude of the specimens. The extra expense is but trifling, compared with the importance of creating an impression. A country whose mineral wealth is only represented by a few insignificant fragments will not be much known, unless the visitors receive verbal or written information that the collection only partially represents its riches.—Large specimens, however, are the heralds of their own and their country's greatness. They make an impression of natural wealth on the mind which cannot be effaced. The name of Canada will be associated with the idea of one of the richest spots on the earth. And what is still better, the idea in this instance, will be in no way an exaggeration. The bed of ore from which the first of the above mentioned specimens was procured is situated about six miles from Bytown, in the township of Hull. It is about 400 feet thick, and of such an excellent quality that it will yield about 75 per cent. of pure iron. It rises into a dome-shaped mound about 70 or 80 feet above the level of the surrounding land, and it is computed that there are three millions of tons of it above the surface. The only mining operations, therefore, that will be required for a long time will be to break it up, and several thousand tons of it have been already quarried and are now being transported. It was lately purchased by J. Forsyth, Esq., of Pittsburgh, in the State of Pennsylvania, who intends to convey it to that place and smelt it along with other ores. It requires an amount of scientific knowledge, and a thorough acquaintance with the resources of other countries, such as is possessed by but one man in Canada, to take charge of a matter of this kind; and no person can witness Mr. Logan's operations without being at once convinced that this Province will be creditably represented at Paris in 1855, as it was in London in 1851.—*Bytown Citizen.*

Railways in Canada.

Schedule of the several Companies incorporated for the construction of Railways in Canada, from the date of the first Charter (25th of February, 1832) to the close of the session of 1852.

Name of Company Incorporated.	Amount of Capital.	No. of Miles under contract, and	No. of Miles completed.
	$		
1. Champlain & St. Lawrence	200,000	—	16
Branch Lines of do.	200,000	—	52
2. Cobourg	1,600,000	Charter expired.	
3. Great Western and Branches	10,000,000	55	240
4. Hamilton and Port Dover	2,000,000	40	—
5. Erie and Ontario	600,000	—	17½
6. Toronto and Lake Huron	2,000,000	Not commenced.	
7. Niagara and Detroit	2,000,000	Charter expired.	
8. Huron and Ontario	1,400,000	Charter expired.	
9. Quebec and Provinces Line	———	Charter expired.	
10. London and Davenport	200,000	Charter expired.	
11. Canada Union	400,000	Not commenced.	
12. Upper and Lower Ottawa	120,000	Charter expired.	
13. Eastern townships	600,000	Charter expired.	
14. St. Lawrence and Atlantic	2,000,000	—	130
Branch Lines of ditto.	———	115	—
15. Montreal and New York	3,460,000	—	—
Branch of 120 Miles	———	Not commenced.	
16. Montreal and Kingston	4,000,000	Not commenced.	
17. Wolfe Island, Kingston and Toronto	4,000,000	Charter expired.	
18. Peterboro' and Port Hope	1,000,000	100	—
19. Hamilton and Toronto	1,800,000	45	—
Branch	———	85	—
20. St. Lawrence and Industry	48,000	—	13
21. Woodstock and Lake Erie	2,000,000	75	—
22. Bytown and Britannia	40,000	Charter expired.	
23. Carrillon and Grenville	240,000	—	12
24. Canada, New Brunswick, and Nova Scotia	8,000,000	Not commenced.	
25. Montreal and Province Line Junction	300,000	Not commenced.	
26. Toronto and Goderich	3,000,000	Charter repealed.	
27. Montreal and Vermont Junction	400,000	68	—
28. Ontario, Simcoe, and Huron	2,000,000	4½	92½
Branch	1,000,000	60	—
29. St. Lawrence and Ottawa	———	Not commenced.	
30. Industry and Rawdon	36,000	—	10
31. Quebec and Richmond	———	See Grand Trunk.	
32. Quebec and St. Andrews	3,000,000	Not commenced.	
33. Bytown and Prescott	6,000,000	—	63
34. Kingston and Toronto	3,000,000	Not commenced.	
35. Toronto and Guelph / Extension of do.	———	Included in Gr'd Trunk.	
36. Wolf Island	200,000	Not commenced.	
37. Grand Trunk of Canada	16,000,000	—	—
Icreased by amalgamation of Companies to	38,000,000	720	392
38. Grand Trunk of Canada East, (included in Grand Trunk)	———		
39. Cobourg and Peterboro'	———	—	25
40. Galt and Guelph	560,000	16	25
41. Grand Junction, (included in Grand Trunk)	———		
42. Buffalo, Brantford, and Goderich	4,000,000	78	80
43. North Shore Railway	2,400,000	145	—
44. London and Port Sarnia	2,000,000	60	—
45. Montreal and Bytown	2,000,000	120	—
46. Megantic Junction	400,000	Not commenced.	
47. Port Whitby and Lake Huron	———	Not commenced.	
48. Brockville and Ottawa	2,000,000	130	—
49. Stanstead, Shefford, and Chambly	3,000,000	95	—
50. London and Port Stanley	609,000	25	—
51. Vandreuil	1,000,000	34	—
52. Cataraqui and Peterboro	1,500,000	Not commenced.	
53. Port Dalhousie and Thorold	300,000	5	4
54. Bytown and Pembroke	1,600,000	Not commenced.	
55. Perth and Kemptville	600,000	Not commenced.	
56. Prince Edward	1,400,000	Not commenced.	

From these statistics the following summary appears:—Total number of Charters granted to Railroad Companies, 56; number of Companies whose charters have expired from *non user*, 10; number of Companies which have not as yet commenced laying down their roads, 14; number of roads now in the course of construction in the Province 32. Belonging to the latter class, 1,193 miles have been completed, and 2,022 are more or less advanced, besides a vast number of miles of road which have not yet been commenced.

Railway Influence.—The forests at the head of the Androscoggin and Connecticut rivers, have been quadrupled in value in the last four years, and a similar result is found along the streams of Canada, in the neighbourhood of the line. It will be seen by reference to the returns of the Grand Trunk Railway for the week ending June 3, that over a half million feet of lumber was moved on that road, and from the new operations going forward along the line, we may predict that another year it will average one million feet a week.—*State of Maine*

Etching Liquid for Lithographers.—Chevallier and Langlume propose for the purpose six parts of fused *chloride of calcium*, dissolved in nineteen parts of rain-water and filtered. In this solution, four parts of gum-arabic are to be dissolved, and one part of pure muriatic acid added to it. This solution serves at the same time to etch, to gum, and, by its penetrating the stone, to keep it moist during the printing—a matter of great consequence.

Elements of Food.

The following tables, by Dr. Angus, of Manchester, show the quantity of the elements of plants contained in the food annually consumed by a hundred adult persons, as ascertained by actual observation. The 44,400 lbs. of farinaceous food are taken as about equal to 93 quarters of wheat, which would grow on about 20 acres of good land:

Quantities of the Elements of Food contained in the Provisions consumed by 100 *Adult Persons.*

	44,400 lbs. farinaceous food.	26,000 lbs. of potatoes and vegetables, 4 lbs. per week each.	36,500 pints of beer, at 15 gals to the bush., 300 bushels of malt, 1 pint ⅌ day each.	13,000 lbs. of meat, or 11,143 lbs. deducting 1-7th for fat 2½ lbs. per week each.	4,333 lbs. of bone,	4,600 lbs. of cheese, 2 oz. ⅌ day each.	Total quantities.
	lbs	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Potass and Soda -	368	193	103	70	13	80	827
Lime and magnesia	177	20	58	10	2·889	4	3·158
Phosphoric acid -	486	13	85	60	1·039	30	1·713
Silica - - - - - -	21	3	142	....	....	....	166
Metallic oxides -	5	fract'n	....	fract'n	....	....	6
Nitrogen - - - -	1·021	94	242	580	75	300	2·312
Sulphur and chl'ne	....	23	4	4	2	54	87

Quantities of the Elements of Food removed from 100 *Acres of Soil by the usual four-course system; and the Quantities which would be supplied by the Excretion of* 100 *Adult Persons.*

	25 acres of wheat, five quarters per acre.	25 acres of barley, five quarters per acre.	From the land in flesh of animals.	40 lambs, at 90 lbs. each.	Four calves.	Four young cows.	Two young horses.	Carried away from 50 acres of barley and wheat, and 50 acres of green crops.	Excretions of 100 adults contain.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs-
Potass and Soda -	470	395	10	8	2	4	2	780	827
Lime and magnesia	350	225	144	250	27	45	22	948	3·168
Phosphoric acid -	680	430	145	210	21	42	21	1·549	1·713
Silica - - - - - -	30	420	...,.	....	....	....	....	450	166
Metallic oxide - -	4	4	....	...'	....	....	....	8	6
Sulphur & chlorine	...	,...	5	12	1	2	1	21	87
Nitrogen- - - - -	1·360	1·030	113	128	15	23	12	2·681	2·312

Distances between leading Cities in the United States.

The following table will show the distance between some of the leading points of the United States by the nearest mail routes. That a better judgment may be formed of tho extent of the country, they are compared with nearly equi-distant foreign cities:—

American Cities.	Distance in miles.
Pittsburg to Boston	616
New York to Mobile	1,476
Philadelphia to Pensacola	1,443
Boston to Nashville	1,590
Albany to Richmond	506
New York to Charleston	790
New York to Cleveland (Ohio)	671
Boston to Galveston (Texas)	2,256
New York to Astoria (land route)	3,523
New York to Astoria (via Cape Horn)	17,500
New York to Astoria (via Panama)	6,200
New York to San Diego, California (land route)	3,732
Charleston to Hartford	900
New York to New Orleans	1,640
Falls of St. Anthony to mouths of Mississippi River	2,200
Sources of Mississippi to mouths of Mississippi	2,986
Pittsburg to New Orleans, via river	2,175
Nearly equi-distant American and Foreign Cities.	
Paris to Vienna	625
Paris to St. Petersburg	1,510
St. Petersburg to Constantinople, land route	1,490
Paris to Berlin	510
London to Vienna	760
Paris to Rome	700
Stockholm (Sweden) to Madrid	2,150
London to Ispahan, Persia	3,589
Liverpool to Canton, via Cape of Good Hope	18,000
London to Delhi, Hindostan	5,337
New York to Bremen, across Atlantic	3,800
London to Rome	910
London to Constantinople, by land	1,490
Stockholm (Sweden) to Tunis (Africa)	2,200
St. Petersburg to Thebes, Egypt	2,800
St. Petersburgh to Madrid	2,100

The citizen of the United States arriving at New Orleans from New York has passed over a distance more than equal to that separating London from Constantinople, or Paris from St. Petersburg. If he has taken the land route to Astoria, his travel will be nearly as great as from New York to Bremen; if the water route, he will have made a voyage nearly equal to one from London to Canton.

Consumption of Smoke.

The London Athenæum says, "In the pages of a Contemporary of Saturday last, we read a paragraph anouncing a new invention that has been put into successful operation at Messrs. Cubitt's, the builders of Gray's Inn Road. This invention is described as effecting the "complete suppression of smoke," and as causing an enormous economy of fuel, the saving being declared to be at the rate of 7 out of every 11 bushels of coal:—a rather startling statement. It is not our purpose, however, just now, to question the truth of that statement; but to remark on the waste of the inventive faculty occasioned by the want of a good system of public record, by which inventors could ascertain whether what they are doing has not previously been effected by some one else. The plan referred to above is that of washing the ponderable matter out of the smoke by means of a jet of water playing in the chimney, or in a passage through which the smoke is made to pass. Not many months since, a patent was applied for in London, and Provisional protection granted for an American invention precisely similar to that referred to above: and the patent was abandoned because it was ascertained that the same thing had been invented and patented years ago in this country. The original inventor, in this country, so far as we know, was Mr. Muntz, of Birmingham, the Member of Parliament, who was examined as a witness before the Select Committee of the House of Commons on Smoke Prevention, which sat in 1843. It seems that a model had been exhibited to the Committee, by some other person, "with ascending and descending flues, and a shower of water," and Mr. Muntz being asked if he had seen it, replied "I took out a patent for that in 1816 myself." So far as the evidence is before us, it seems that in 1843 some one else expounds a like plan, and seems to have patened it; in 1853 the same thing is again invented in the United States, and a patent is again applied for in England, and provisionally obtained; and lastly, Messrs. Cubitt adopt an apparently identical plan which is ushered to the world with the honours of originallity.—Much has certainly been done of late towards systematizing our information on these subjects: but here is evidence how much more has to be effected before the faculties of invention will be freed from the chances of waste."

Copper Smoke and Copper Men.—The vocation of the copper man is distinguished from that of almost every other craftsman in this particular—that working in the face of an intense fire, high temperature, and its consequences, are superadded to hard labour. Exposed for 12 hours to a heat alternating between 130° and 55°, the furnace-man, working before an intense fire, or sitting in a cold draught, will constantly within that period consume a quantity varying from two to three gallons of water. This raises a curious question, applicable to many of our operatives, whether a man who loses gallons of fluid by perspiration every day throughout the year is liable to waste? Statistics, if rigorously compiled on this subject, would occupy years; but general observation, and the assurances of the men themselves, will suffice to set all doubt at rest. In all the works of the district it is quite common to find men hale, florid, and even corpulent, in personal appearance; and those who have passed 20, 30, and even 40 years before the furnace livingly solve the problem. Emaciated and lean are not more commonly met with amongst those veteran furnace-men who have perspired 600 gallons within the year, than amongst labourers in general; 50 such men lately assured our author that they were precisely the same weight as they were twelve months ago, although, as a counterpoise to such perspiration they had consumed within that period 800 or 1000 gallons of water. The conclusion arrived at is, that the sweating of the workman labouring before the fire does not affect the frame, when that frame is saturated with water; that the nutrition of the body proceeds, even though deluged with the fluid.—The fusing point of copper is 1500°, and often, in the midst of a heat radiating from such a temperature, the furnace-man works bravely for two consecutive hours, and then retires to cool himself and to drink.—While direct experience supports what is physiologically reasonable, that it is by alternately drinking and sweating that the man is enabled to sustain the heat of an intensely powerful furnace, and the fatigue of very exhausting labour, indigestion is found to prevail amongst them. This Thomas Williams, M.D. of Swansea, attributes to drinking large quantities of cold water too soon after meals; but he assures us that organic diseases of the stomach are not more common amongst them than amongst other men who support themselves by their labour.—*Mining Journal.*

Railway Suspension Bridge at the Falls.—This noble structure is expected to be completed by the first of January, and the first train will probably pass over it on that day. The Rochester *American* gives the following dimensions of the Bridge, as furnished by the Archtect, Mr. J. A. Roebling:

Length or distance from the centre of the towers	feet	822
Height of the towers above the rocks on the New York side	feet	98
Height on the Canada side	feet	37
Height to the railroad track	feet	60
Height of the track above the water	feet	260
Number of wire cables		4
Diameter of cables	inches	10
Number of strands of No. 9 wire in cable		3,659
Total power of the cables	tous	12,400
Weight of the entire bridge	tons	750
Weight of the bridge and of the heaviest load that can be put upon it	tons	1,250
Greatest weight which the cables and supports can bear	tons	7,300

The Railways of Maine.—The *State of Maine* says, that upon the completion of the Somerset and Kennebec and the Penobscot and Kennebec roads, which may be looked for at an early day in January, the Railway system for Maine, including its Canadian connections, will embrace the following aggregate of Railway lines, continuing at or radiating from Portland.

	Length, miles.		Cost.
Portland, Saco and Portsmouth	51		$1,459,384
Portland and Montreal	292		11,419.000
Quebec Branch	100		3,152,000
Androscoggin and Kennebec	55		2,200,000
Kennebec and Portland	72		2,605,365
Androscoggin Railroad	20	about	350,000
Somerset and Kennebee	21	about	400,000
Penobscot and Kennebce	55		1,100,000
Buckfield Branch	13		250,000
York and Cumberland	18		800,000
Bangor and Piscataquis	12		138,000
Totals	709		24,064,749

Expansive Force of Steam.—Taking the "Lord of the Isles" locomotive, which attracted so much attention at the Exhibition of 1851, and the steam at 120 lbs. per square inch above the atmosphere, it gives an aggregate force of 17,438 tons, as calculated from the surface it acts against within the boiler.

Thus, the pressure on the cylindrical shell round the tubes	= 1259·57	tons.
On the smoke box tube plate	= 90·53	"
On the fire-box and plate	= 376·54	"
On the two outer sides of fire-box	= 502·07	"
On the outer top plate of fire-box	= 392·46	"
On the tube plate of fire-box	= 95·10	"
Total pressure on outer shell	= 2716·27	tons.
Pressure on the 303 tubes, each 2 inches in diameter	= 13,569·87	"
Pressure on the inner copper fire-box	= 1152·41	"
Total pressure as divided over the boiler	= 17,438·55	tons.

confined in about 205 cubic feet of space, of which about 42 cubic feet are filled with steam, and 163 cubic feet with water. This is the quiescent force under ordinary conditions, as it is confined in a space of about 205 cubic feet, but which on release seeks instantaneously to occupy a space of about 277,436 cubic feet, equal to atmospheric pressure, which gives some idea of the gunpowder-like expansion of steam and water in explosions. The steam expands with an elastic force equal to that of eight atmospheres, or say to 336 cubic feet, and the water to about 1700 times its own volume, or about 277,100 cubic feet, making a total volume of 277,436 cubic feet, into which they would expand at the moment of explosion. The steam produces only about 1-825th part of the expansive force, so that the explosive force of the water is by far the most formidable element in all boiler explosions.

Coal versus Sinews.—It has been proved, says Prof, Henry president of the Mechanic's Institute at Washington, that, on an average, four ounces of coal are sufficient to draw on a railroad, one ton a mile. It has also been found on experiment, that a man working on a treadmill continually for eight hours, will elevate 1,500,000 lbs. one foot high. Now, Cornish engines will perform the same work by the expenditure of 1½lbs. of coal. It follows from these data that about 5 tons of coal would evolve as much power during its combustion as would be equal to the continued labour of an able bodied man for 20 years, at the rate of 8 hours per day; or, in other words to the average power of a man during the active period of life.

Large Water-wheel.—We see by the local press that a large water-wheel has been recently started at a mine in the Isle of Man. The wheel is 72 feet 6 inches in diameter, and 6 feet wide; the shaft is of wrought iron, forged at the Mersey Forge, Liverpool: it is about 21 inches diameter, and 17 feet long, weighing 10 tons. The arms are of wood, and the rim of cast iron. It is a breast-wheel, and the water is conveyed from a reservoir by a cast-iron stand-pipe of 2 feet diameter, around which is built a tower of masonry, which gives a peculiar and picturesque appearance to the wheel. A crank on the shaft has 10 feet stroke, and the motion is communicated by means of flat rods to the mouth of the pit, where, by means of a bob, a stroke of 8 feet is given to the pumps. We presume that a crank and rods are placed at each end of the shaft. We do not see any utility in employing a wrought-iron shaft for such a purpose. A hollow cast-iron shaft would have been much cheaper and lighter, and less liable to vibration.—*Artizan.*

Manufacture of Sugar in France.—The quantity of sugar made from beet-root to the end of the fourth month of the season, February, was 73,987,419 kilogrammes, being very nearly equal to the entire season of September, 1852, to September, 1853. No branch of commerce in France has been so successful as the fabrication of sugar from beet-root. The original discovery of the process was due to M. Thiery, a common clerk in the office of the Prefect of Lille, and who shortly after became director of the first beet-root sugar factory erected in France, at Passy, and who, as a reward for his valuable invention, received from the Minister of the Interior, in the year 1810, the sum of 300 francs.—*Brussels Herald.*

Solvent Action of Common Salt at High Temperatures.—Forchhammer, after a long series of experiments, has come to the conclusion that common salt at high temperatures, such as prevailed at earlier periods of the earth's history, acted as a general solvent, similarly to water at common temperatures. The amount of common salt in the earth would suffice to cover its whole surface with a crust ten feet in thickness.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—November, 1854.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude*, 79 *deg.* 21. *min. West.* *Elevation above Lake Ontario*, 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
1	29·376	29·401	29.448	29·428	47.0°	51·2°	38·6°	45·8°	+ 5·35°	0·263	0·224	0.206	0·227	·82	.61	·89	76	W b N	W b S	W	0·0[illegible]	0·095	...
2	·657	·535	·402	·535	35.5	51·9	54·2	47·3	+ 7·07	·180	·239	.223	·217	87	63	54	69	W S W	S W b W	SW b W	13·2[illegible]	·005	...
3	·671	·879	·930	·844	38.4	38·5	38·2	37·7	— 2·33	·144	·130	.200	·156	62	56	87	69	N N W	N W b W	S W	9·4[illegible]	....	...
4	30·039	30·174	30.196	30·143	29·1	29·7	17·5	24·3	—15·43	·098	·098	.078	·089	60	58	77	66	N	N b W	N	8·97	...	Inap
5	30.149	30·049	—	—	18·0	34·0	—	—	—	·084	·152	—	—	82	78	—	—	N b E	S E b S	—	8·14	Inap.	...
6	29·444	29·170	29·095	29·230	42·4	48·0	43·5	44·5	+ 5·32	·182	·232	.247	·223	68	70	89	77	S b W	S W bS	W b S	10·08	·140	...
7	·125	·153	·385	·243	33·4	47·1	34·6	37·8	— 1·18	·138	·192	.172	·175	72	60	86	77	W b S	N W	N N W	6·55	·020	. .
8	·481	·579	·722	·605	33·4	43·4	28·2	34·1	— 4·58	·151	·165	.121	·233	78	60	77	73	W b S	N W b W	Calm	6·96	...	...
9	·856	·858	.773	·825	32·7	34·7	35·9	34·1	— 4·32	·164	·156	.149	·155	89	78	70	80	W N W	E	N E b E	5·59	...	...
10	·656	·504	·366	·501	36·8	48·2	48·3	44·5	+ 6·42	·183	·244	.318	·255	84	73	95	86	N E b E	E	Calm	3·93	·150	...
11	.338	·510	·652	·518	48·5	47·1	35·2	42·8	+ 5·03	.302	·223	.171	·224	90	70	84	81	Calm	W b N	Calm	4·07	...	...
12	·725	·537	—	—	31·6	48·3	—	—	—	·160	·226	—	—	90	67	—	—	N	E N E	—	9·37	·315	...
13	·330	·416	·513	·435	42·0	39·5	32·5	37·0	— 0·18	·188	·175	·160	·179	77	73	87	83	SW b W	W S W	W S W	10·74	Inap.	...
14	·526	·467	·237	·396	34·5	34·3	37·3	35·3	— 1·57	·172	·160	·201	·178	86	80	91	86	W S W	W S W	S W b S	9·11	·040	0·2
15	.119	·121	·283	·186	35·5	41·7	40·6	38·8	+ 2·33	·191	·234	·205	·207	93	89	82	89	Calm	Calm	N N E	1·95	·045	...
16	·402	·389	·317	·370	35·9	36·5	30·8	34·4	— 1·82	·180	·156	·149	·160	86	73	86	81	N N W	N N W	Calm	7·87	·040	...
17	28·937	28·820	28 980	·917	38·2	39·8	38·4	37·9	+ 2·12	·191	·190	·182	·184	83	78	79	81	S W b S	W S W	W S W	6·40	·035	...
18	29.017	29·128	29·249	·151	30·2	40·2	31·6	34·1	— 1·43	.136	·192	·152	·161	81	78	86	82	Calm	W	Calm	3·53	Inap.	Inap.
19	·437	·519	—	—	31·6	35·8	—	—	—	·149	·124	—	—	85	59	—	—	N W	N N W	—	5·79	...	0·1
20	·522	·499	·595	·543	30·2	35·0	30·5	31·3	— 3.47	·158	·152	·161	·153	94	74	95	87	Calm	N W b N	Calm	1.99	...	0·2
21	·692	·661	·506	·616	23·7	34·0	35·5	30·7	— 3·63	·113	·157	·180	·149	86	79	87	85	Calm	E b S	E S E	4·33	...	0·8
22	·434	·515	·553	·504	31·6	35·7	35·8	34·1	+ 0·02	·162	·170	·188	·172	92	82	90	88	N N E	Calm	SW b W	0·60	...	...
23	·471	·335	·229	·331	38·4	48·5	42·0	42·7	+ 9·05	·208	·258	·231	·233	90	77	87	86	Calm	S E b S	E S E	1·35	·090	...
24	·004	28·735	28·708	28·800	46·7	50·0	47·8	48·1	+14·78	·294	·314	·284	·297	93	89	88	90	E	E b S	S E b S	5·70	·135	...
25	28·685	28·809	28.937	28·825	39·8	39·9	36·8	39·0	+ 6.02	·188	·191	·179	·188	78	78	82	80	S S W	SW b W	S W	10·21	·005	...
26	28 987	29·079	—	—	35·5	36·6	—	—	—	·180	·148	—	—	87	69	—	—	S W	SW b W	—	13·98	...	...
27	29·406	29·580	29.627	29·562	27·8	39·6	34·2	33·4	+ 1·18	·131	·176	·157	·154	85	73	78	80	N W b W	W N W	SW b W	10·70	...	...
28	·676	·640	·646	·657	30·2	35·6	33·0	32·4	+ 0·48	·150	·145	·155	·147	89	70	82	80	W S W	S W	S W	10·99	...	...
29	·557	·475	·525	·523	34·8	39·5	30·7	34·9	+ 3·48	·169	·174	·139	·162	84	73	80	78	S W	S W	W N W	12·60	...	Inap.
30	·675	·725	·788	·733	24·4	24·9	16·2	20·7	—10·32	·100	·087	·079	·085	74	66	82	73	N W	N W b N	W N W	13·16	...	Inap.
M	29·427	29.426	29·449	29·439	35·43	40·56	35·69	36·8	+ 0.69	0·175	0·186	0·180	0·180	83	71	83	80	7·66	9·46	5·80	7·58	1·115	1·3

Highest Barometer...... 30·196, at 10 p. m. on 4th } Monthly range:
Lowest Barometer....... 28·685, at 6 a.m. on 25th } 1·511 inches.
Highest registered temperature 55°·4, at p.m. on 2nd } Monthly range:
Lowest registered temperature 13°·8, at midnt. on 30th } 41°·6.
Mean Maximum Thermometer.............. 42°·08 } Mean daily range:
Mean Minimum Thermometer.............. 28°·13 } 13°·94.
Greatest daily range.........29°·1, from a.m. of 5th to a.m. of 6th.
Warmest day....... 24th. Mean temperature...... 48°·05 } Difference,
Coldest day......... 30th. Mean temperature...... 20°·77 } 27°·28.
Greatest intensity of Solar Radiation, 64°·0 on p. m. of 2nd } Range.
Lowest point of Terrestrial Radiation, 8°·6 on a. m. of 21st } 55°·4.
Aurora observed on 3 nights: viz. 8th, 11th, and 20th.
Possible to see Aurora on 13 nights.
Impossible to see Aurora on 17 nights.
Raining on 13 days. Raining 34·1 hours; depth, 1·115 inches.
Snowing on 4 days. Snowing 16·5 hours; depth 1·3 inches.
Sheet Lightning occurred on the 1st, 2nd and 17th.
No Thunder Storms recorded this month.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1610·75	3368·02	1681·60	685·26

Mean direction of the Wind, W 1° S.
Mean velocity of the Wind, 7·58 miles per hour.
Maximum velocity, 28·1 miles per hour, from 7 to 8 a. m. on 30th.
Most windy day, the 26th; mean velocity, 13·98 miles per hour.
Least windy day, the 22nd; mean velocity, 0·60 " "

The Barometric depression on the 24th and 25th was extreme, being 0·823 and 0·798 below the corresponding means for these days in November. This depression has only been exceeded on two instances during the last 15 years.

The mean velocity of the wind for this month has been 2·09 miles per hour above the average, being the most windy November recorded since 1847.

November 1854 was an extremely dry month, although a measurable quantity of rain fell on 13 days, yet the total quantity was only 1·115 inches on the surface, which is 1·799 inch less than the average.

Comparative Table for November.

Year.	Temperature. Mean.	Dif. from Av'ge.	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind. Mean Velocity.	
1840	35·9°	—0·7°	54·4°	20·5°	33·9°	5	1·220	8	...	...	
1841	35·0	—1·6	63·2	7·6	55·6	8	2·450	5	...	0·91	lb.
1842	33·3	—3·3	50·6	7·6	43 0	9	5·310	10	...	1·22	lb.
1843	33·5	—3·1	51·2	14·4	36·8	10	4·765	7	1·2	0·59	lb.
1844	34·9	—1·7	49·8	12·0	37·8	8	Impf	4	8·0	0·48	lb.
1845	36·8	+0·2	58·8	7·6	51·2	7	1·105	4	5·0	0·53	lb.
1846	41.3	+4·7	55·5	18·2	37·3	12	5·805	2	0·4	0·64	lb.
1847	38·6	+2·0	58·2	7·8	50·4	14	3·155	3	Inap.	4·77	Miles.
1848	34·5	—2·1	49·3	16·5	32·8	9	2·020	3	1·4	4·81	Miles.
1849	42·6	+6·0	56·7	28·4	28·3	10	2·815	2	1·0	4·78	Miles.
1850	38·8	+2·2	62·3	18·1	44·2	7	2·955	1	Inap.	5·27	Miles.
1851	32·9	—3·7	50·1	16·5	33·6	5	3·885	6	6·7	4·70	Miles.
1852	36·0	—0·6	50·4	18·7	31·7	7	1·775	3	2·0	6·50	Miles.
1853	38·7	+2·1	54·1	14 4	39·7	15	2·425	6	2·7	5·52	Miles.
1854	36·8	+0·2	54·9	15·1	39·8	13	1·115	4	1·3	7·58	Miles.
										0·73	lbs.
M'n.	36·64		54·63	14·89	39·74	9·3	2·914	4·5	2·5	5·49	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——November, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	29·522	29·519	29·632	54·2	56·1	46·6	·349	·287	·262	·81	·62	·80	W	W S W	W b N	16·56	8·76	6·38	...	...	Str. 8.	Cum. Str. 5.	Cum. Str. 9.
2	·810	·827	·705	36·7	50·0	44·6	210	220	223	91	59	73	W N W	W S W	S b W	5·76	9·30	9·00	0·260	...	Clear.	Clear.	Str. 10.
3	·844	30·034	30·230	37·8	38·1	26·6	182	158	146	76	64	88	W N W	W b N	N W	21·62	13·50	11·13	...	...	Cum. Str. 2.	Cum. 2.	Clear.
4	30·220	30·486	30·500	27·1	24·6	17·0	156	112	074	94	71	64	W N W	N W	N W b N	2·16	12·96	5·58	...	Inap.	Sl't Snow 5 am	Clear.	Do.
5	30·513	30·465	30·300	10·7	32·2	20·0	074	160	089	82	82	68	N W b W	S	S b E	1·30	0·50	Calm	...	...	Clear.	Do.	Do.
6	30·302	30·312	30·346	26·0	33·4	33·0	135	178	187	83	86	90	S S E	S	S	9·15	12·14	6·13	...	...	Do.	Str. 10.	Light. Cir.
7	29·432	29·384	29·482	36·7	41·0	34·0	200	242	195	89	88	91	S	S W b S	W N W	35·17	4·30	3·71	0·539	...	Rain at 6 a.m.	Rain.	Cir. Str. 8.
8	·554	·660	·866	30·6	31·4	26·0	160	171	141	86	89	88	W b N	W N W	W N W	12·67	12·17	17·62	...	...	Cum. Str. 8.	Cir. Str. 6.	Do. 9.
9	·871	30·110	30·189	14·4	24·0	25·0	091	127	141	87	85	90	W N W	W N W	W N W	18·43	13·86	5·78	...	...	Clear.	Clear.	Str. 2.
10	30·110	30·035	29·941	21·6	31·0	27·0	111	158	156	83	81	96	E N E	N E	N E b E	0·37	7·05	7·29	...	...	Str. 4.	Str. 10.	Str. 10.
11	29·779	29·750	·765	44·0	44·3	42·6	292	292	293	96	94	1·00	E S E	E S E	W	6·92	1·92	1·33	0·790	...	Rain.	Cir. Str. 9.	Cir. Str. 2.
12	·929	·919	·998	37·0	42·8	33·2	220	280	207	94	98	1·00	W b S	N E b E	N E b E	1·26	2·31	12·00	Inap.	...	Cum. Str. 9.	Str. 10.	Fog.
13	·605	·612	·710	41·0	50·0	39·2	269	349	196	98	93	76	N E b E	W b S	W b S	15·01	8·80	3·25	0·542	...	Rain.	Cir. Str. 8.	Cir. Str. 2.
14	·730	·698	·651	35·0	40·1	36·0	196	227	210	89	85	91	W S W	W S W	W S W	5·42	3·52	7·77	...	...	Clear.	Do. 2.	Do. 2.
15	·890	·571	·580	32·6	39·0	33·5	206	235	207	98	91	1·00	N	N E b E	N E b N	3·30	3·20	2·96	...	...	Sleet.	Cir. Str. 8.	Sleet & Rain.
16	·605	·600	·544	33·0	41·0	33·0	197	253	178	95	92	86	N E b N	N E b N	N	7·86	7·01	Calm	0·273	...	Cir. Str. 9.	Do. 4.	Cir. Str. 10.
17	·512	·270	·227	30·8	34·4	32·0	178	214	192	93	98	96	W S W	S S E	S b E	6·21	1·16	6·25	...	1·10	Str. 2.	Sleet & Snow	Snow.
18	·357	·472	·520	34·0	40·2	33·1	216	245	207	99	92	98	S S W	N W	N E b E	2·85	Calm	Calm	0·700	...	Rain.	Cir. Str. 4.	Clear.
19	·620	·684	·744	31·8	37·8	29·0	178	226	157	92	91	76	N E	W b N	W b N	Calm	1·85	9·20	...	...	Cir. Str. 10.	Do. 4.	Do.
20	·782	·785	·847	22·4	29·2	23·0	108	152	112	87	85	77	W b N	W b N	N W b W	12·50	10·37	5·17	...	...	Clear.	Clear.	Do.
21	·938	·990	30·002	18·1	28·5	21·3	106	153	112	87	86	80	N W	N W	N W	3·21	Calm	0·25	...	...	Do.	Do.	Do.
22	·862	·822	29·849	22·6	26·1	24·8	108	141	135	80	88	86	N E b E	N E b E	N E b N	9·17	6·25	9·12	...	...	Snow.	Snow.	Str. 10.
23	·932	·831	·733	26·3	31·8	27·9	147	184	153	90	89	89	W	S E	N E b E	1·03	0·38	1·58	...	...	Str. 10.	Str. 10.	Do. 10.
24	·572	·409	·320	28·0	38·0	36·7	163	209	218	94	85	91	N E	E N E	N E b E	0·62	2·62	2·00	0·866	...	Do. 10.	Cir. Str. 10.	Rain.
25	·001	28·989	·241	42·0	45·1	38·6	291	272	226	98	90	91	N E b E	S W	S W b S	3·09	6·31	6·42	0·628	...	Rain.	Thun. at 12·35	Str. 4.
26	·240	29·291	·440	37·9	38·7	35·9	236	244	192	99	98	84	S W b W	W b S	S W b W	0·62	2·93	11·25	0·532	...	Do.	Cir. Str. 4.	Str. 4.
27	·588	·720	·838	30·6	29·2	24·0	178	161	127	92	89	85	W b S	W b N	W S W	15·00	5·16	5·26	...	Inap.	Snow.	Do. 4.	Clear.
28	·996	·930	·982	33·0	39·0	35·0	197	234	198	95	91	84	S W b W	W S W	S b W	2·00	2·02	3·62	...	...	Clear.	Do. 2.	C. Str. 4.
29	·900	·870	·770	30·9	37·0	30·1	171	184	168	90	77	90	N b W	W b N	W b N	1·00	0·18	Calm	...	...	Do.	Do. 4.	Light Cirs. 2.
30	·591	·672	·814	30·0	25·0	17·0	168	112	106	90	71	89	W b N	W S W	W	2·54	12·20	18·51	...	...	Str. 8.	Do. 9.	Cir. Str. 8.

Barometer	Highest, the 5th day	30·513
	Lowest, the 25th day	28·989
	Monthly Mean	29·764
	" Range	1·524
Thermometer.	Highest, the 1st day	60°·6
	Lowest, the 5th day	10°·0
	Monthly Mean	32°·99
	" Range	50°·6
	Mean Humidity	·878
Greatest Intensity of the Sun's Rays		117°·8

Rain fell on 10 days, amounting to 5·130 inches. Raining 29 hours, 40 minutes.
Snow fell on 3 days, amounting to 1·10 inches. Snowing 7 hours 45 minutes.
Most prevalent Wind, W.N.W. Least prevalent Wind, N.
Most Windy Day, the 3rd day; mean miles per hour, 15·41.
Least Windy Day, the 18th day; mean miles per hour, 0.95
Aurora Borealis invisible this month. Might have been seen on 9 nights.
Electrical State of the Atmosphere has been marked by rather high tension of a negative character.
Ozone was present in the atmosphere in large quantities during the month.

Monthly Meteorological Register, Quebec, Canada East, November, 1854.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	29·163	29·251	29·369	29·263	56·5	55·7	43·0	51·7	0·387	0·339	0·218	0·315	86	77	79	81	S W	S W	S W	13·9	10·1	7·2	0·04	...	
2	·502	·602	·534	·546	36·2	44·2	42·6	41·0	·165	·170	·168	·168	78	60	62	67	S W	S W	S W	5·2	12·9	7·2	·05	...	2d. At 8, p.m., Lunar Halo.
3	·408	·734	·983	·708	44·8	36·7	26·4	36·0	·253	·097	·108	·153	86	45	74	68	S W	W N W	W N W	11·3	11·3	11·3	...	...	3d. Observed snow on the Mountains.
4	30·037	30·088	30·228	30·118	25·0	22·1	13·6	20·2	·092	·116	·074	·094	66	94	85	82	Calm.	N	N	0·0	5·2	6·2	...	2·2	
5	30·249	30·243	30·177	30·223	10·4	21·1	15·6	15·7	·069	·091	·080	·080	94	78	86	86	W b S	W	Calm.	7·2	5·2	0·0	...	...	
6	30·000	29·713	29·566	29·760	16·3	32·0	32·7	27·0	·076	·109	·142	·109	78	60	75	71	S b E	S b E	S b E	2·0	3·8	3·8	...	·9	
7	29·348	·263	·261	·291	33·1	36·3	36·0	35·1	·181	·213	·206	·199	96	100	98	98	N E	N E	N E	10·2	6·2	6·2	·93	0·3	
8	·227	·277	·458	·321	32·9	34·7	26·3	31·3	·174	·176	·133	·161	94	89	92	92	N E	W	W	7·2	11·3	12·4	·09	...	8th. Snow, which melted as it fell.
9	·650	·792	·930	·791	12·1	22·5	18·0	17·5	·065	·092	·070	·076	80	74	70	75	W N W	W	W	22·7	11·3	10·0	...	...	
10	·982	·951	·851	·928	16·4	27·6	27·8	23·9	·085	·091	·125	·100	88	59	81	76	W	S W	E N E	8·0	3·8	8·0	...	...	
11	·813	·646	·638	·699	32·0	36·3	37·7	35·3	·152	·213	·208	·191	84	100	93	92	E N E	E N E	E N E	8·8	12·9	6·2	1·34	...	
12	·820	·843	·840	·834	36·7	36·9	33·0	35·5	·204	·206	·188	·199	95	95	100	97	Calm.	Calm.	W S W	0·0	0·0	2·0	·04	...	
13	·659	·433	·527	·540	37·9	36·7	38·0	37·5	·210	·210	·213	·211	93	97	94	95	N E	N E	Calm.	21·3	11·5	0·0	·46	...	
14	·494	·444	·430	·456	38·0	40·0	36·4	38·1	·197	·166	·156	·173	87	68	73	76	Calm.	S W	S W	0·0	7·2	5·2	...	...	
15	·449	·406	·406	·420	34·6	38·1	35·2	36·0	·175	·151	·163	·163	89	66	80	78	S	N	N E	3·8	8·0	10·0	...	·5	
16	·403	·328	·288	·340	33·0	36·4	33·6	34·3	·175	·162	·168	·168	94	76	88	86	Calm.	N N E	Calm.	0·0	7·2	0·0	...	1·2	
17	·196	·154	·129	·160	31·1	34·5	31·1	32·2	·140	·156	·174	·157	80	78	100	86	W N W	Calm.	Calm.	3·8	0·0	0·0	...	2·8	
18	·218	·306	·395	·303	34·7	37·0	35·6	35·8	·175	·190	·200	·188	88	87	96	90	Calm.	N E	Calm.	0·0	2·0	0·0	·18	...	
19	·416	·439	·371	·409	33·8	36·1	34·5	34·8	·182	·193	·145	·173	95	91	73	86	Calm.	Calm.	W	0·0	0·0	5·2	...	...	19th. Auroral Light visible at 10 p.m.
20	·382	·454	·552	·463	29·5	29·1	25·7	28·1	·130	·117	·099	·115	79	72	70	74	W	W	W	2·0	5·2	8·0	...	...	
21	·676	·765	·864	·768	18·2	21·4	17·8	19·1	·080	·079	·082	·080	78	67	80	75	W	W	W	6·2	6·2	6·2	...	...	
22	·863	·761	·710	·778	19·9	22·7	26·3	23·0	·096	·121	·132	·116	85	97	91	81	W	N E	N E	8·0	13·9	17 9	...	1·5	
23	·703	·607	·567	·626	25·9	29·5	28·9	28·1	·129	·133	·138	·133	89	81	87	86	N N E	S E	Calm.	11·3	8·0	0·0	...	...	
24	·477	·374	·300	·384	30·5	34·3	34·5	33·1	·153	·165	·193	·170	90	83	97	90	Calm.	E	E	0·0	5·2	19·0	·70	...	
25	·163	28·958	·106	·076	38·6	45·3	43·0	42·3	·224	·268	·239	·244	96	90	88	91	E N E	E N E	E N E	22·7	21·3	6·2	·20	...	
26	·113	29·037	·192	·114	38·5	38·4	33·1	36·7	·216	·210	·180	·202	93	92	100	95	Calm.	Calm.	W N W	0·0	0·0	13 9	·22	1·0	26th. This amount of snow is estimated as it melted as it fell.
27	·296	·449	·630	·458	34·0	31·9	28·0	31·3	·163	·146	·131	·147	83	81	86	83	W N W	W N W	W N W	17·9	8·0	6·2	...	1·5	
28	·704	·698	·798	·733	25·6	31·0	34·0	30·2	·126	·160	·164	·150	89	93	83	88	W N W	Calm.	Calm.	3·8	0·0	0·0	...	1·8	
29	·778	·677	·524	·660	33·2	36·8	32·4	34·1	·162	·151	·177	·163	86	70	96	84	W S W	N	Calm.	6·2	5·2	0·0	...	2·5	
30	·288	·235	·413	·312	32·6	34·1	22·5	29·7	·176	·160	·101	·146	95	80	82	86	Calm.	W	W	0·0	10·9	9·3	...	0·6	
	29·5492	29·5309	29·5679	29·5494	30·73	33·98	30·78	31·83	0·160	0·162	0·152	0·158	85	80	87	84				6·78	7·13	6·25	4·25	16.53	

Maximum Barometer, 6 a.m. on the 5th .... 30·249
Minimum Barometer. 2 p.m. on the 25th., ... 28·958
Monthly Range .... 1·291
Monthly Mean.................... 29·5494
Maximum Thermometer on the 1st .... 59°.8
Minimum Thermometer on the 5th. .... 10°·0
Monthly Range .... 49·8
Mean Maximum Thermometer .... 35·95
Mean Minimum Thermometer .... 25·95
Mean Daily Range .... 10·00
Mean Monthly Temperature .... 31·83

Greatest Daily Range of Thermometer on 3rd .... 24°·6
Least Daily Range of Thermomter on 29th .... 3°·9
Warmest Day, 1th. Mean Temperature .... 51·7
Coldest Day, 5th. Mean Temperature .... 15·7
Climatic Difference .... 36·0
Possible to see Aurora on 6 Nights.
Aurora visible on 4 Nights.
Total quantity of Rain, 4·25 inches.
Total quantity of Snow, 16·53 inches.
Rain fell on 10 days.
Snow fell on 12 days.

The Canadian Journal.

TORONTO, FEBRUARY, 1855.

Address of the President of the Canadian Institute.

Delivered January 6th, 1855.

Messrs. Vice-Presidents and Gentlemen of the Canadian Institute,—I cannot but regard it as a compliment that you have placed me a second time in the office of President, though I confess I had difficulty in persuading myself that I ought not peremptorily to decline it, for reasons which I stated on the last similar occasion, and which I need not now repeat.

It was my expectation, and (if I may take the liberty of saying it) my hope that you would have found it possible this year to nominate a gentleman to preside over your proceedings, who, having some leisure time at his command, which I have not, would possess the further qualification, which I equally want, of being able, from his previous pursuits, to apply his leisure usefully in aiding your exertions for the promotion of science. That you have not found it convenient to relieve me has arisen, I suppose, from some impediment not yet explained; but let me take the liberty of intimating that, whenever the time shall come (and I think it cannot be distant), when you can make a more satisfactory arrangement, you need not allow yourselves to be embarrassed, in making the change, by any scruples as regards myself, for that would, I assure you, be an obstacle altogether imaginary.

In the mean time, you will allow me to bring before you a few considerations which have occurred to me respecting the condition and prospects of the Association.

The last annual report, read at a late meeting by the Secretary, gave a favourable view of the state of the Canadian Institute, both in regard to the increasing number of its members, and the condition of its finances.

It appears that in the last two years the number of members has increased from 112 to 333, of which 135 joined in the year 1853, and 86 in the last year.

This is certainly a very encouraging progress; and it seems not too much to say that the number of members thus early attained, is such as to afford a reasonable assurance of the efficiency and stability of the Institution, and to give good ground of hope that, by an united exertion, its affairs may soon be placed in a condition that will afford to its more active members additional facilities, and enable the Association to attract to itself more general countenance and support.

Of course, whatever hopes may be indulged of the good to be accomplished, and the reputation to be acquired by the Canadian Institute, the extent to which such hopes can be realized must wholly depend upon the talent and knowledge to be found among its members, and the use which they may be able and willing to make of them in promoting the interests of science. The inducements to voluntary exertion in so honorable a cause, are the same here that exist in other countries, and the field for exertion is neither more limited nor less interesting. There are, indeed, in Canada, at the present time, some peculiar inducements to the prosecution of scientific inquiries, which need not be pointed out.

No expense is grudged, and no labour spared, in cultivating the minds of the youth of the Province of all ranks, and such are the efforts which are being made to this end, that it does not appear extravagant to say that we may expect, in a few years, to find ourselves living among a people, who, to speak of them in the mass, will be as able as any other that can be named, either ancient or modern, to comprehend the nature and value of discoveries that may be made in the arts and sciences, and to adopt and improve upon such suggestions as may be thrown out by men of superior genius and attainments.

If the system of Common School education which pervades all parts of Upper Canada, shall continue to be maintained in full efficiency, which there is no reason to doubt, the number of those who can enter with pleasure and profit into discussions upon subjects of science will be immensely increased; and those whose generous aim it may be to enlighten and improve others by communicating freely the results of their own researches and experiments, will find abundance of hearers and readers able to understand and reason upon their theories.

There is good ground, too, for the expectation that, with the advantage of the public libraries, selected as they are with care and judgment, which are being formed within the several counties, and even within each school section, a spirit of inquiry will be fostered, and an ambition excited to be distinguished in scientific pursuits, which we may hope will in time add largely to the number and variety of interesting contributions to the Institute.

It is a most gratifying circumstance that the Legislature, at the suggestion of the Government, has, within a few weeks, added to its usual grant of £250 for the general purposes of the Association, a further sum of five hundred pounds expressly towards providing a building for its accommodation. This generous act of encouragement is of great importance, because it seems to insure the early accomplishment of the object which it is intended to assist, and it denotes a confidence in the proceedings of the Association, as well as an interest in its success, which cannot fail to supply additional motives to exertion. It gives, also, good ground for hope that as time advances, and as the benefits which may be derived from this Association become more and more developed, the Legislature will not be found wanting on their part in affording such further aid as may seem necessary, provided they find that their grants have been judiciously applied, and have been made the means of conferring a corresponding benefit upon the community.

The grant which I have mentioned will be found sufficient, it may be hoped, to enable the Society to proceed in erecting a building without delay, especially as no part of it will be required to be expended in purchasing a site—a charge from which the Institute will happily be relieved by the generous liberality of the late Secretary. If durability, convenience, and neatness of design be principally consulted in the style of building, without sacrifices being made to architectural ornament, to which our funds will be unequal, the Association need not, I hope, be long without enjoying a home of its own; not one by any means adequate to what we may venture to suppose its purposes will in the course of time require, but one in most respects better than the temporary home, which, by the kindness of the Government, we are at this moment occupying.

It will be no difficult matter, I suppose, with the assistance which the professional knowledge and good taste of many of our members will supply, to devise a plan of such a building as will admit of extension, from time to time, by additions which will be in harmony with the main design. The first step will natu-

rally be to fix upon a plan of such a building, or portion of a building, as will answer reasonably well for present purposes, and to ascertain what sum would be sufficient to complete it. We should then soon be able to satisfy ourselves whether the cost could or could not be met by such efforts as are within our power. I have no apprehension that it could not be; on the contrary, I am persuaded it would be found by no means impossible to proceed with reasonable despatch, and without interruption to the completion of a suitable building.

And there can be no question, as I think we must all feel, that we are bound so to act as to show that we are not indifferent to the interest which has been so kindly manifested by the Legislature in favour of this Association. The encouragement which has been given to us does indeed impose upon us a corresponding responsibility, and makes it a duty to show that we are not unworthy recipients of the public bounty.

In connection with this consideration of duty, it is not out of place to allude to a proposition which has been made by a very zealous friend of science, and urged, indeed, upon the Institute with a laudable earnestness and perseverance. I refer to a suggestion of Major Lachlan, one of the members of the Institute, who resides in Montreal, that we should endeavour to make provision for taking and recording, at different points in Upper Canada, a series of simultaneous meteorological observations, such as might materially assist, if conducted with care and perseverance, in elucidating the laws and explaining some of the phenomena of nature. Indeed, Major Lachlan, in a clear and well-considered paper, which was read before the Institute, pressed more than one object of this description upon its attention; and I shall best state his suggestions by using his own words:

He proposed, in the first place, that there should be in some manner established, through the intervention of the Society, a well-organized chain of daily simultaneous meteorological observations at a number of well-selected stations throughout Canada, with Toronto for its centre, to be connected with a similar arrangement which he ventured to hope might be set afoot in each of the Lower Provinces, and so conducted as to be readily connected with the extended system of meteorological registers already in operation in the United States, under the fostering auspices of the Government, and the various philosophical Associations of that country. He recommended, also, in the second place, the establishment of a simultaneous record of the rise and fall of the great Canadian Lakes, throughout their whole extent.

No one, I think, can rationally question the value of these suggestions. It is obvious that if this Association could be made the means of accomplishing such objects upon a system well considered and steadily carried out, they would be rendering a service to the cause of science which could not fail to be highly appreciated, and they would be placing themselves in a most favourable light, not merely with our own Government and people, but with all friends of science on this continent and elsewhere.

It may be objected that it is too early to engage in an attempt of this magnitude, for that our resources are inadequate to the undertaking. I confess my inability to dispose satisfactorily of this difficulty, because I have not a sufficient knowledge of what ought to be the details of an extensive system of this kind, to be able to count the cost. But it is clear that to count the cost, with the assistance of those who are able to estimate the difficulty, must be the first step; and I would with much diffidence suggest that it seems a reasonable mode of dealing with such a question, that we should first consider what would be the probable expense attending the proposed system of simultaneous observations (carried on in the first place throughout Upper Canada,) upon a scale as extensive as would be desirable, both in regard to the number of stations, and the variety and minuteness of the observations to be recorded. Then having arrived at a safe opinion upon that point, the next step would be to determine how that expense, which no doubt would be large, could be brought within the compass of our means, by a reduction in the number of stations, or by limiting the range of observations to be conducted at each point.

One considerable charge, no doubt, would be for the instruments that would be required, because, to be of any value for such a purpose, they should be of the best construction; but I do not imagine that a serious difficulty would be found in meeting that charge.

The expense of arranging the observations when collected and returned, and of classifying and comparing them, and printing the results, would no doubt be rather formidable, but I take the greatest difficulty to be, the finding or providing a person capable of conducting such observations at each station which it might be desirable to establish, and more especially at some of those points remote from towns and settlements, where the observations that might be taken would possess a particular value, but where we could scarcely expect to find gentlemen residing who could be relied upon for conducting accurately observations which require some degree of leisure, minute and patient attention, and competent intelligence, and skill to use the instruments entrusted to them.

Any difficulty of this kind, however, applies rather to the number and position of the points of observation to be maintained, than to the practicability of establishing some system of the kind on a scale, which though confined as to extent, might still be eminently useful to the cause of Science, and supply valuable materials for confirming or disproving theories which in themselves are of great interest, and can only be established or refuted by such means. I take the liberty of suggesting that if something satisfactory in this way can be effected by any exertion at all within our means, and with such public aid as we might hope to procure, it would be unwise to incur unnecessary delay. It is only from a series of observations of each particular kind, conducted through a succession of years, that results can be obtained on which reliance can be placed. We should be impatient, therefore, to begin what can only produce fruits so gradually, and there is a particular reason against delay which appears to me to have much force in it.

Among the speculations which interest men of science, we find it frequently discussed, what effect has been produced upon climate by the progress of cultivation in countries which originally were covered thickly with timber. Now we have at this moment large tracts in this Province, particularly in the north-western part of Upper Canada, in which the change from wilderness to cultivated fields is going on most rapidly—some in which it is but just commencing, and others in which it is not yet actually begun. In all portions of this immense tract, the process of clearing the land of its timber is certain to go on with speed; for the advantages of Upper Canada as regards climate, fertility of soil, means of transportation, and proximity to markets are now at length known and understood, and population is pouring into the new townships with surprising rapidity. It is to be considered too, that our system of assessment laws ensures reports being annually made of the number of

acres of cleared land in each township,—thus affording the means of comparison, year by year, as to the quantity of land in cultivation, and its proportion to that which remains still in a state of nature,—and affording also through such comparison the means of judging what effect the clearing up of the country has upon the climate, as regards heat and moisture. It would seem to give occasion for regret, that such an opportunity of obtaining a knowledge of interesting facts of this description should be lost, for the results of observations taken under circumstances so favourable, might materially tend to correct false impressions, and establish the truth upon points which have given rise to a great deal of speculation among philosophers.

For these reasons, among others of more weight, that might be mentioned, it does seem to deserve immediate and earnest consideration, whether progress cannot at once be made in acting upon the suggestions which I have referred to.*

I will detain you, gentlemen, but a few moments longer, while I solicit your attention to some reflections which have naturally presented themselves in connection with the Institute.

We have here an association formed for the advancement of Science, established by Royal Charter, and which the Government and Legislature have very early condescended to countenance and encourage by some very gracious marks of confidence and goodwill. The Province, I will venture to say, contains a very fair proportion, if not its due proportion, of men of cultivated minds, active intelligence, and of laudable enterprise and ambition.

Can there then be any reason why the Canadian Institute may not be made to do for Canada whatever the spontaneous and united efforts of learned men have been able to do in other countries for the promotion of the Arts and Sciences?

There is certainly nothing in our political system to fetter the mind—no barrier to mental improvement presented by any impediment physical or moral, but on the contrary, unusual encouragement from the certainty that the decisive, comprehensive, and well-sustained measures that have been taken for the general diffusion of education must soon have the effect of raising the standard of knowledge among the inhabitants of Canada much above the ordinary level in other countries.

If a large expense were inseparable from the maintenance of such associations as this, still that consideration need not operate more strongly as a discouragement in Canada than in other countries, for it would be no easy matter to point to any part of the world in which wealth is more rapidly accumulating, though undoubtedly, the proportion of individuals possessed of large wealth is less in Upper Canada, than in countries where commerce and manufactures have flourished for a much longer period. But in truth large means are not required for our purpose. Nothing can be more simple and inexpensive than the system by which literary and scientific institutions of this nature proceed to accomplish whatever it is in their power to effect.

A building suitable for the purpose is clearly indispensable: this calls for an expenditure which must be once incurred, and the earlier the better. But after that shall have been accomplished, although large means might no doubt be usefully applied in promoting objects fairly within the range of such institutions, yet a large expenditure is by no means necessary for the attainment of its purposes to an extent that would be useful and satisfactory.

There are contingent expences of an ordinary kind not to be avoided, for which a certain and adequate provision should be made with as little delay as possible, for until this has been done on a reasonable scale, there can be neither comfort nor efficiency in the management of any such Association. But a very moderate sum will be sufficient for this purpose and for all beyond it, such as the gradual collection of books, and whatever is necessary for illustrating the different Sciences we may trust to the benefactions of liberal patrons, and the continued aid of the Legislature, which we may trust will not be withheld if the institution shall be found to be steadily advancing in the path of usefulness.

As an instance of the manner in which this Association may be made to assist in serving very important interests, I refer to the late publication in a Supplement to the Canadian Journal of the several papers upon the improvement and preservation of the Harbour of Toronto, which were submitted by different gentlemen to the Harbour Commissioners, with diagrams illustrating the subject—which subject I need not say is one of extreme interest not only to this rising city but also to a large surrounding country.

And I may refer to the papers of Mr. Billings, a native of this Province, which have been spoken of so approvingly in the last report of the Council, as proof of the tendency which the Canadian Institute must have to stimulate and encourage those whose tastes happily lead them to prosecute with ardor such investigations.

They have thus presented to them an opportunity of submitting conveniently the fruits of their observations for discussion and examination among men of similar intellectual habits and pursuits—who can estimate their value and understand the difficulties which have been overcome—and they have in the Journal of the Institute a channel well adapted for conveying the results of their researches to those quarters where they are most likely to receive attention.

Whatever can assist materially to strengthen in the minds of Canadian youth an attachment to such studies, or to assist them in pursuing them, must be acknowledged to be important not merely as it tends to render them more valuable members of society, but as it makes them in themselves more happy, multiplying their sources of rational and innocent enjoyment, increasing their self-respect, and saving them from the dangers of idleness, and from the remorse which sooner or later must follow an ill-spent life.

* The suggestions referred to have undergone the consideration of the Committee of the Council, which very recently reported, but they thought it advisable, before recommending any special steps to be taken, that correct information should be procured of the working of a system, which has been in operation some years in the United States; but they had taken steps to procure such information, and were not prepared until it was received to recommend any definite course of action.

Observations Suggested by Specimens of a Class of Conchological Relics of the Red Indian Tribes of Canada West.

Read before the Canadian Institute by Daniel Wilson, LLD.;
Professor of History and English Literature,
University College, Toronto.

Among the numerous relics of the Indian tribes pertaining to the northern regions of this continent, there is one class, consisting of certain large species of the sea shells of the Gulf of Mexico and the West Indian Islands, and of articles of personal ornament fashioned from these, which appear to present some special claims to attention.

Two of these tropical American shells, both of them specimens of the *pyrula perversa*, the native habitats of which are the Antilles, and the Bay of Campeachy, on the main land, have been recently presented to the Canadian Institute; not as additions to our specimens of native conchology of the tropics, but as Indian relics pertaining to the great northern chain of fresh water lakes. The first of these, presented by Dr. Richardson at a meeting of the Institute in January last, was discovered on opening an Indian grave-mound, at Nottawasaga, on the Georgian Bay, and along with it a gorget made from the same kind of shell. The second example, presented by Sandford Fleming, Esq., was brought by him from the Fishing Islands, near Cape Hurd, on Lake Huron; while a third specimen now exhibited, the property of James Beaty, Esq., constituted one of the contents of a large sepulchral depository in the same Northern Lake district. It was found lying at the head of one of a group of Indian graves, along with a copper kettle, and other relics; and the graves are reported to have contained additional specimens of the pyrula.

About the year 1837, one of those extensive Indian Ossuaries, which have furnished so many relics pertaining to the period of ancient Indian occupation of the Canadian clearings, was accidentally discovered in the township of Beverly, twelve miles from Dundas. Here an elevated ridge, running from north to south, was covered by an old growth of full-grown beech trees, standing somewhat widely apart; and across this, and consequently running from east to west, a series of deposits of human bones were exposed, ten or eleven of which were opened. They contained an immense number of bones, of both sexes and of all ages, promiscuously heaped together, and interspersed with many Indian relics, which furnished the chief temptation to their exploration. These depositories of human bones are referred to by Dr. Schoolcraft, as specially characteristic of the ancient period of occupancy of the Upper Lakes, and are described as consisting of "sepulchral trenches or ossuaries, in which the bones of entire villages would seem to have been carefully deposited, after the bodies had been previously scaffolded or otherwise disposed of, till the fleshy parts were entirely dissipated, and nothing left but the osteological frame." In commenting on this Indian sepulchral rite, he further observes: "A custom of this kind may be supposed to intervene, in the history of nations, between that of burning the body,—which is still practised, we are told, among the Tacullies of British Oregon, or New Caledonia,—and that of immediate interment, which is so generally practised."* On enquiring, however, of Mr. Paul Kane, whose practical knowledge of Indian rites and customs is so extensive, he informs me that in the above remarks this American ethnologist confounds the customs and sepulchral rites of two entirely distinct classes of the Indian tribes of North America. Among the Chippeways, the Pottowatamays, the Menamonies, the Ottawas, and the Indians of the Six Nations, the practice prevailed of interring their dead in large sepulchral depositories, into which the bones were promiscuously gathered, after the final honours and sacrifices had been offered to the deceased. This custom fully accounts for the large Ossuaries brought to light within the original localities of these tribes. The other practice of depositing the corpse on a scaffold or raised platform above ground, constitutes the entirely distinct and final sepulchral rite of other tribes lying to the north and west of the former, including the Chinouks, Kliketats, Coulitz, and all the Indians of the Columbia River. The most common and characteristic elevated bier of these western tribes is the canoe, raised on poles, and decorated with relics pertaining to the deceased; and with the offerings of his friends. These Indian biers are invariably erected on an isolated rock or island, inaccessible to beasts of prey, and are regarded as the final resting-places of the dead.* With reference to the ossuaries of the eastern tribes, such as those now more especially referred to, discovered at Beverly, it may be noted that they indicate a permanent location of the tribe, and may afford some clue to the duration of their occupation of the region of country where such are brought to light.

One of the depositories of bones opened at Beverly, and carefully explored, was found to measure forty feet in length, with a breadth of eight feet; and throughout this entire area it consisted, to a depth of six feet, of a solid mass of human crania and bones.

Along with numerous specimens of clay pipes, beads, amulets of red pipe-stone, copper bracelets, and personal ornaments of different kinds, obtained from the Beverly ossuaries, there were found various shell-beads, a worked gorget made from a large sea-shell, with the original nacre of red not entirely gone, and two entire specimens of the large tropical sea-shells already referred to. One of these furnishes another specimen of the *pyrula perversa*, and the other is described as the *pyrula spirata*, a shell, if I mistake not, peculiar to the western coasts of Central and South America. The shell beads, it may be added, appear to be of precisely the same kind as some described in the transactions of the American Ethnological Society, (Vol. 1, 1835) which were discovered far south, in the Grave creek mound, Virginia.

The interest which pertains to these conchological Indian relics, manifestly depends on the fact of our thus discovering along the shores of our great inland chain of fresh-water lakes specimens of the large tropical sea-shells of the Atlantic and Pacific Coasts of Central America, and of the West Indian Isles. The attractions offered by this and other allied species of the large and beautiful tropical shells are sufficiently apparent, and are by no means limited to the untutored tastes of the Red Indian, nor to the products of the Mexican coasts.

The *Pyrum*, and others of the large and beautiful shells of the East Indian seas, of the species *Turbinella*, are highly prized by the natives of the neighbouring districts; and this is especially the case with a sinistrorsal variety which inhabits the coasts of Tranquebar and Ceylon, and is made use of by the Cingalese in some of their most sacred rites. The greater number of the genus *Pyrula*, are dextrorsal, or rise in a spiral line from right to left so as to present the mouth on the right side when held with the elongated canal or tube downward. Such is not the case, however, with the two species referred to as belonging to this continent, and hence apparently the origin of the name given to the more abundant of these, the *Pyrula Perversa*.

In the East Indian Seas, however, examples of sinistrorsal monstrosities of the native species are occasionally met with, and are highly prized. Such reversed shells of the species *Turbinella*, are held in special veneration in China, where great prices are given for them. They are kept in the pagodas by the priests, and are not only employed by them on certain

* History, Condition, and Prospects of Indians of the United States," vol. 1. pp. 68, 102.

* Mr. Paul Kane exhibited at the meeting an oil painting executed by him from sketches taken on the Coulitz River, of a group of the canoe biers of the Coulitz Indians, among whom he resided for some time.

occasions as the sacred vessels from which they administer medicine to the sick; but it is in one of these *sinistrorsal turbinella* that the consecrated oil is kept, with which the emperor is anointed at his coronation.

It is probably in reference to this custom that Meuschen, who considered what is now recognised as the full-grown shell a different variety from the smaller one—called by him the *Murex Pyrum*—gave to it the name of *Murex Sacrificator*.*

These shells are often curiously ornamented with elaborate carvings, fine specimens of which are preserved in the British Museum. In the Synopsis of the Zoological Galleries in that Museum, it is remarked, "The *Turbinella* from their form have been called turnip shells. These are often used as oil vessels in the Indian temples, and for this purpose are carved and otherwise ornamented, as may be seen by some in the collection. When reversed, they are much sought for by the Ceylonese, and highly valued; one of these reversed shells is in this collection. They are said to sell for a very large price in Ceylon and China."

In the great basin of Lake Superior, and in the higher latitudes beyond—the regions occupied by the Algonquin Indians—the traces of older occupation are, with one exception, few and slight. Dr. Schoolcraft remarks of this region :—"There are no artificial mounds, embankments, or barrows, to denote that the country had been anciently inhabited. . . It is something to affirm that the mound-builders, whose works have filled the West with wonder, had never extended their sway here. The country appears never to have been fought for, in ancient times, by a semi-civilized, or even pseudo-barbaric race. There are but few darts or spear heads. I have not traced remains of the incipient art of pottery, known to the Algonquin and other American stocks, beyond the Straits of Saint Mary, which connect Lakes Huron and Superior; and am inclined to believe that they do not extend in that longitude beyond the latitude of 36° 30′. There is a fresh magnificence in the ample area of Lake Superior, which appears to gainsay the former existence, and exercise by man, of any laws of mechanical or industrial power, beyond the canoe-frame and the war-club. And its storm-beaten and castellated rocks, however, imposing, give no proofs that the dust of human antiquity, in its artificial phases, has ever rested on them."

It is in this region that the great mineral treasures are found which attracted the attention of the native Indians long before the discovery of this continent by Columbus or Cabot, and in that prehistoric period of America furnished the chief element of traffic, and the consequent source of intercourse between the north and south. I have referred in a former communication* to the working of the copper by the Indians of Lake Superior, without any skill in the metallurgic arts, and indeed without any precise distinction between the copper which they mechanically separated from its native matrix, and the unmalleable stone or flint out of which they were ordinarily accustomed to fashion their spear and arrow heads. This metal, Dr. Schoolcraft remarks, "was employed by the Indians in making various ornaments, implements, and instruments. It was used by them for arm and wrist-bands, pyramidal tubes, or dress ornaments, chisels and axes; in all cases, however, having been wrought out exclusively by mere hammering, and brought to its required shapes without the use of the crucible or the art of soldering. Such is the state of the manufactured article, as found in the gigantic grave creek mound, and in the smaller mounds of the Scioto Valley, and wherever it has been scattered, in early days, through the medium of the ancient Indian exchanges. In every view which has been taken of the subject, the area of the basin of Lake Superior must be regarded as the chief point of this intermediate traffic in native copper. In exchange for it, and for the brown pipe stone of the Chippewa River of the Upper Mississippi, and the blood-red pipe-stone of the Coteau des Prairies west of the St. Peters, they received certain admired species of sea-shells of the Floridian Coasts and West Indies, as well as some of the more elaborately and well-sculptured pipes of compact carbonate of lime, grauwacke, clay slate, and serpentines, of which admirable specimens, in large quantities, have been found by researches made in the sacrificial mounds of the Ohio Valley, and in the ossuaries of the Lakes. The makers of these may also be supposed to have spread more northwardly the various ornamented and artistic burnt-clay pipes of ancient forms and ornaments, and the ovate and circular beads, heart-shaped pendants and ornamented gorgets, made from the conch, which have received the false name of ivory, or fine bone and horn. The direction of this native exchange of articles appears to have taken a strong current down the line of the great lakes, through Lake Erie and Ontario, along the shores of the States of Ohio and New York, and into the Canadas. Specimens of the blood-red pipe-stone, wrought as a neck ornament, and of the conch bead pendants and gorgets, &c., occur in the ancient Indian burial grounds, as far east as Onondaga and Oswego, in New York, and in the high country about Beverly, and the sources of the several small streams which pour their waters into Burlington Bay, on the north shores of Lake Ontario."*

In view of this ancient traffic between the north and south, the conchological relics now referred to are of peculiar value. Whatever doubt may be thrown on the derivation of the specimens of ancient native manufacture, or of the copper found in sepulchral and other deposits in the Southern States, and in Central America, no question can be made as to the tropical and marine origin of the large shells now exhibited, and brought from the inland districts, lying between the Ontario and Huron Lakes, or the still remoter shores and islands of Georgian Bay, at a distance of not less than two thousand miles from the shores of Yucatan, on the main land, where the *pyrula perversa* is found in its native locality.

It is obvious from the large and cumbrous size of the American *pyrulæ*, that they must have possessed some very peculiar value or sacredness in the estimation of the Indian tribes of the northern regions, to encourage their transport from so great a distance, through regions beset by so many impediments to direct traffic. Their transport to the Canadian Lake regions appears to have been practised from a very remote period. Dr. Schoolcraft describes specimens of the *pyrula perversa* obtained by him in these regions in an entire state, among traces of Indian arts and customs, "deemed to be relics of the Ante-Cabotian period;" and from the circumstance of their discovery in sepulchral mounds, and laid at the head of the buried chief, with his copper kettle and other peculiarly prized relics, the *pyrula* of this continent would appear to have been held in no less veneration by the natives of America, than the Asiatic species now are by the native Cingalese, or the more civilized and cultivated priests of China. The examples found are generally more or less marked or ornamented. The

* Dillwyn's Descriptive Catalogue of Recent Shells, p. 569.

* Canadian Journal, vol. ii., p. 214.

* History, &c., of Indian Tribes," vol. i., p. 67, 68.

shell now exhibited from Nottawasaga has the upper whorls removed, so as to expose the internal canal. Five lines, or notches, are cut on the inner face of the canal, and it is perforated on the opposite edge, showing in all probability where the wampum, scalp-lock, or other special decoration of its owner was attached. It also exhibits abundant traces of its long and frequent use. The surface is smooth and polished, as if by constant handling, except where it is worn off, or decayed, so as to expose the rough inner laminæ of the shell: and all the natural prominences are worn nearly flat by frequent attrition. We shall not probably greatly err in assuming the *pyrulæ* thus venerated by the ancient Indians of Canada West, to have closely corresponded to the *Conopas*, or rude Penates of the Peruvians, as described by Rivero and Von Tschudi. Any singular or rare object in nature or art seems to have sufficed for one of these Peruvian minor deities, amulets, or charms. "Every small stone or piece of wood of singular form was worshipped as a conopa. These private deities were buried with their owners, and generally hung to the neck of the dead."* The choice of natural objects for their singularity of form is thus seen to present the same psychological characteristic which leads to the Chinese veneration for the sinistrorsal turbinella.

Trifling as such relics of Indian superstition, or of the rude traffic of barbarous tribes, may appear, they are not without some value to us, both in regard to the light they throw on the ancient history of this continent, and also, perhaps, in respect to some of the forms in which the progressive civilization of its new occupants may be modified by the same physical causes which largely controlled the ancient intercourse between north and south, and between west and east.

In no respect is this continent, to which these Indian relics pertain, more directly diverse from that of Europe than in its broadly-marked physical characteristics. The greatest diameter of Europe is from east to west, so that its chief area of occupation is embraced within a nearly similar range of temperature. Yet along with this climatological homogeneity, its surface is broken up by mountain ranges, and its coasts indented by bays, estuaries, and land-locked seas, by means of which its various populations are even now isolated as by clearly defined natural lines of demarcation. Altogether different is it with this continent, where the great levels are so little broken, that not only the boundaries of properties and townships, but even of states, provinces, and dominions, are drawn without reference to any natural features of the country, excepting in the cases of the great lakes, the St. Lawrence, the Rio Grande, and very partially in that of the Mississippi. We have to note, moreover, that the most important navigable river of Europe flows from east to west, in one parallel of latitude, and through a population in all ages rendered somewhat homogeneous by influences of climate and all external circumstances: but the Mississippi and the Missouri flow together through 20° of latitude, with all the varieties of climate still further increased on a continent which extends its widest area within the arctic circle, and where consequently the curves of equal temperature, in the isothermal lines drawn across the two continents, approach as much towards the equator in the meridian of Canada as they recede from it in that of the west of Europe, while under the tropics the isothermal lines are everywhere parallel to the equator.

Looking back into the most ancient history of Europe, we find that that continent also had its northern mineral treasures; its *tin*, pertaining to the Kassiterides, or British Islands, and its amber, found then as now in most abundance on the shores of the Baltic. But it was by maritime intercourse, through the agency of the Phœnician merchantmen of Asia, that the north of Europe exchanged its mineral treasures for the coveted possessions of regions lying towards the tropics. Herodotus, in the earliest known reference to the British Isles as the source of tin, refers to them only to declare his total ignorance of them; and in noticing the rumour that amber is brought from the northern sea in which they lie, he says:—"I am not able, though paying much attention to the subject, to hear of any one that has been an eye witness that a sea exists on that side of Europe." Nor did this singular isolation, so peculiarly characteristic of Europe, disappear even in the later ages of Roman rule. Dr. Arnold, in contrasting our knowledge of the globe with the ignorance of earlier ages, remarks:—"The Roman colonies along the Rhine and the Danube looked out on the country beyond those rivers as we look up at the stars, and actually see with our eyes worlds of which we know nothing."

The class of Indian relics to which I have drawn attention, when taken into consideration with the copper weapons, implements, and ornaments of Southern grave mounds, appear to throw a light on the past history of this continent in its antehistoric ages, and to show it then as now, as clearly distinct in political as in physical characteristics from ancient or modern Europe. Europe never could be for any length of time the area for a nomadic population. In America, with its great unbroken levels, even the home-loving Anglo-Saxon becomes migratory, and seems to lose in a degree his old characteristic of local attachment. In Europe the diverse ethnological elements are still kept apart by its physical features: the Iberian of Ante-Christian centuries surviving in the Pyrenees, and the Gaul and Briton of the first century finding still their representatives on the coasts of Brittany, and in the mountains of Wales. But on this continent a homogeneous aboriginal population appears to have occupied nearly its entire area; and now that its ancient tribes are being displaced by the colonists that Spain, England and Ireland, Poland, Hungary, France and Germany, pour unceasingly on its shores, the distinctions of Iberian, German, Celt and Saxon, which have survived there for well nigh two thousand years, appear to vanish almost with the generation that sets foot on this continent. When we consider how largely all European history has been affected by the peninsular character of Greece and Italy, and by the insular character of Britain; as well as, in a secondary degree, by the similar isolation of Spain, France, Denmark, and the Scandinavian peninsula, we cannot fail to perceive in this a key to some of the contrasting elements of fusion already noticeable throughout this continent.

It is obvious that a very different future awaits America from that which fills the ample page of history in relation to Europe. The wars of Marlborough and Wellington, in so far as they constituted practical protests against the dismemberment of Europe's old nationalities, were assertions of the eternal laws written by the finger of God on the whole physical aspect of the continent; and it is in the assertion of a like great principle that England has now once more unsheathed her sword. But on this continent, our own Canadian frontier is, if not the only one, at least one of the very few clearly defined lines, whereby nature has recorded her enduring protest against *annexation*. Southward and Westward, the

* "Peruvian Antiquities," translated by F. L. Hawks, D.D., p. 172.

Anglo-Saxon may still wander, as the old nomade Indian did, when his frail barque bore down the Mississippi the metallic products of our most northern lake shores; and by the same highway the prized products of tropical seas were transferred to the regions of our great inland lakes. One opposing element alone interferes with the apparent adaptation of this continent for one vast empire or republic of the future, and that is the climalotogical variations consequent on the very clement of essential difference between America and Europe: its extreme diameter extending from North to South. The variations of temperature implied in this, are, as has been noticed above, still further increased by the conformation of the continent; and in accordance with this we already see nature asserting the influence of her immutable laws; and while she still facilitates the interchange of the products of the North and South, as in those old times of Indian traffic to which the relics now brought under notice belong, every year seems to increase growing characteristics which so clearly separate the planter of the Southern States from the Anglo-Saxon settlers on the northern area of this continent.

On the Effect of Pressure on the Temperature of Fusion of Different Substances.

By Mr. Hopkins.*

The author began by stating that it was most fortunate for the success of his researches that, in the very commencement of them he had applied to Mr. W. Fairbairn, who had, with the utmost enthusiasm, entered into his views, and aided him to the utmost extent of the incomparable facilities afforded by his celebrated establishment. Mr. Hopkins then gave a short description of the apparatus which he had used, and the successive steps by which failures in some contrivances had led him to that which were ultimately found to answer. In particular how, from the enormous pressures to which the substances were subjected, they found it impossible to use glass to see what was going on within the cylinders in which the substance to be experimented upon was inclosed; which difficulty had been got over by causing an iron ball to rest on the top of the substance within the cylinder; while its presence deflected a small magnetic needle outside, but the instant the melting of the substance inside permits the ball to fall, the magnetic needle returning to its position indicated the fact. The use of this needle made it necessary to make the cylinder of brass; and Mr. Hopkins stated that with the first cylinder they used, they were surprised to find when enormous pressures were laid on that the liquid within wasted; the cause of this they long sought to discover in vain, until at length they found that it was escaping through the very pores of the metal in thousands upon thousands of jets so minute as to be almost imperceptible. This they remedied by greater care in the casting of the cylinder, and hammering it well on the outside. The method of laying on the pressure was by a piston well packed and forced down by a lever. This they adopted as the simplest means of getting a numerical estimate of the actual compressing force.—Mr. Hopkins then described the method by which the friction has been determined which opposed the motion of the piston, and so diminished the pressure by so much. This was done by noting the weight required to drive the piston in a certain small distance; this, less by the friction, was equal to the compressing force; then noting the weight which allowed the piston to return exactly to its first position; this together with the friction, was equal to the compressing force; but as these two compressing forces are equal, the friction is equal to half the difference of the two weights used, and is then a matter of very simple calculation. Mr. Hopkins then gave the results of the experiments, of which the following are the most important :—

Substances experimented upon.	Pressure in lbs. to the Square Inch.			emperature Fahrenheit at which it liquefied.		
Spermacetti...........	0	7,790	11,880	124°	140°	176·5°
Wax	0	7,790	11,880	148·5	166·5	176·5
Sulphur	0	7,790	11,880	225	275·5	285
Stearine	0	7,790	11,880	158	155	165

Of course when the weight 0 was on the piston, the substance was under atmospheric pressure, or about 15lb to the square inch; and the pressure of 7,790lb per square inch was just that at which the Britannia Bridge had been raised. Mr. Hopkins had also tried the metallic alloys which fuse at low temperatures, but had not detected any elevation of fusing temperature required by increasing the pressure; but these experiments required to be repeated and confirmed before they could be relied upon.

* British Association for the Advancement of Science, 1854.—*Athenæum.*

Nouvelles Experiences sur le Mouvement de la Terre au Moyen du Gyroscope.

By M. Foucault.*

The author spoke in French, but very distinctly, and the apparatus was so simple, beautiful, and exquisitely constructed, that the experiments all succeeded to a miracle, and fully interpreted the author's meaning as he proceeded. The gyroscope is a massive ring of brass connected with a steel axis by a thinner plate of the same metal, all turned beautifully smooth, and most accurately centred and balanced; in other words, the axis caused to pass accurately through the centre of gravity, and to stand truly perpendicular to the plane of rotation of the entire mass. On this axis was a small but stout pinion, which served when the instrument was placed firmly on a small frame, containing a train of stout clock-work, turned by a handle like a jack, to give it an exceedingly rapid rotatory motion on its axis. But to this clock-work frame it could be attached or detached from it instantly. This revolving mass was only about three inches wide, and four of them were mounted in frames a little differently. The first was mounted in a ring, attached to a hollow sheath, which only permitted the axle and the pinion to appear on the outside, so that it could be laid hold of, or grasped firmly in the hand, if the pinion were not touched, while the mass inside was rapidly revolving without disturbing that motion. By this modification of the gyroscope, the author afforded to the audience a sensible proof of the determination with which a revolving mass endeavours to maintain its own axis of permanent stable rotation, for upon setting it into rapid rotatory motion, and handing it round the room, each person that held it found himself forcibly resisted in any attempt to turn it round either in his fingers, to the right hand or left, or up or down, or in his hands if he swung it round. So that the idea was irresistibly suggested to the mind, that there was something living within which had a will of its own, and which always opposed your will to change its position. The second modification pre-

* British Association for the Advancement of Science, 1854.—*Athenæum.*

sented the mass suspended in a stout ring, which was furnished with projecting axles, like the ring of the gymbal. These axles could be placed in a small frame of wood, bushed with brass. This small frame, when placed on a piece of smooth board, could be turned freely round by turning the piece of board on which it rested as long as the gyroscope was not revolving, friction being sufficient to cause the one to turn with the other; but when the gyroscope was set rapidly revolving, in vain you attempted to turn the frame, by turning the board on which it rested, so determinately did it endeavour to maintain its own plane of rotation, as quite to overpower the friction. In the third modification of the gyroscope, it was suspended in gymbals, so exquisitely constructed that both the gyroscope proper and the supporting gymbals were accurately balanced, so as to rest freely when placed in any position in relation to the earth. By this the author showed most strikingly the effect of any attempt to communicate revolving motion round any other axis to a mass already revolving, for, on placing the gymbals in a frame of wood while the gyroscope was not revolving, it remained quite steady; but, when thrown into rapid revolving motion, the slightest attempt to turn the frame round to the right or to the left was instantly followed by the entire gyroscope turning round in the gymbals, so as to bring its axis to coincide with the new axis you endeavoured to give it, with a life-like precision, and always so as to make its own direction of revolution be the same as that of the slightest turn you impart to it. Having thus demonstrated the necessary effect of combining one rotatory motion with another, he then proceeded to demonstrate palpably that the earth's revolving motion affected the gyroscope in precisely a similar way. Having, by the screw adjustments, brought the gyroscope, in gymbals, to a very exact balance, it remained fixed in any position when not revolving. But rapid rotatory motion having been communicated to the gyroscope mass as soon as the gymbal supports are placed on the stand, you see the entire apparatus, slowly at first, but at length more rapidly, turn itself round, nor ever settle until the axis, on which the gyroscope is revolving, arranges itself parallel to the terrestrial axis, in such a sense as to make the direction of the revolving gyroscope be the same as that of the whole earth. He next showed that the determination with which it did this was sufficient to control the entire weight of the instrument, though that amounted to several pounds, for, taking the ring gyroscope, from the side of the ring of which a small steel wire projected, ending in a hook, the wire coinciding with the prolongation of the axis of the gyroscope: of course, when not made to revolve, the hook, if placed in a little agate cup at the top of a stand, would permit the instrument by its weight, to fall instantly, as soon as the support of the hand was taken from it. But, upon imparting to it rapid rotatory motion, it stood up even beyond the horizontal position, so as to bring its axis of rotation nearly to the same inclination to the horizon as the axis of the earth, while the whole acquired a slow rotatory motion round the point of the hook; and so steady was its equilibrium while moving thus, that a string being passed under the hook and both ends brought together in the hand, the whole may be lifted by the cord off the stand and carried revolving steadily about the room. Next, to show the motion of the earth sensibly, he placed the gymbal gyroscope suspended freely by a fine silk fibre in a stand with the lower steel point of its support resting in an agate cup; a long light pointer projecting from the ring carried a pointed card which passed over a graduated card arch of a circle placed concentrically with the gyroscope; upon imparting rapid rotatory motion to the gyroscope the index was seen as the earth moved to point out the relative motion of the plane of rotatum exactly in the same way: the law of the motion being also the same as that of the well-known pendulum experiment. Lastly, he set the ring gyroscope in motion, and by placing a small pointed piece of brass at the end of the axle on the ring, the instrument went immediately through all the evolutions of a boy's top on the floor, humming meanwhile loudly also.

On Arctic and Antarctic Currents, and their Connexion with the Fate of Sir John Franklin.

By Mr. A. G. Findlay. *

Allusion was made to a former paper, read to the Association at Hull last year, describing the currents of the Atlantic and Pacific Oceans, in the latter of which it was thought some new features were described. It was shown that a great similarity existed in the movements of the two oceans,—a system of westerly drifts between the tropics, which on arriving at the western side of each ocean turned north and south from the equator on each side of it, and re-curving when beyond lat. 30° N. and S., they passed to eastward, and re-entering their course on the eastern sides, they formed a complete circulatory system. In the present paper it was shown how the Polar regions were connected with these movements, and how tropical warmth reached the poles, and the cooling effects of the extreme climates were brought into more temperate zones. The nature of the enormous magnitude of the antarctic ices, which offer a perfect contrast to those of the North Pole, was explained.—From the southern part of the southern connecting current, which encircles the southern part of the globe between lat. 40° and 50° S., a system of S.E. drifts is found, impelled by the prevailing N.W. winds. These drifts, as found by Capts. Sir J. Ross, Durville, Wilkes, Ballery, and others, run at a rate between ten and twenty-five miles per day towards the vast icy barrier whose limits, as far as known was explained. This enormous collection around the South Pole is purely the result of atmospheric deposition, and is remarkable as lying to the south of the greatest area of ocean water on the earth's surface, and over which the winds pass towards it; but from the fact of all countries in south latitude having arid climates, and those in the north the reverse, this was another evidence that the evaporation of the northern hemisphere is deposited in the south, and *vice versa*. One fact analogous to those observed in the North Atlantic Ocean,—of dust once supposed to be volcanic, but proved to be microscopic Crustacea,—was cited as occurring near to the antarctic circle, and also adding a confirmation of the theory of the atmospheric circulation. The face of the icy barrier, consisting of cliffs elevated from 150 to 210 feet above the sea level, perfectly wall-faced, and extending continuously for hundreds of miles, was an evidence that ocean currents did not penetrate that circle, which we only know from its external edge. These table-topped barriers were the result of surface deposition, and, being above 1,000 feet thick, were of sufficient solidity to be protruded bodily downwards from the interior lands, which might consist of mountains of solid ice of sufficient inclination seawards to allow the set of the stratified upper portions to glide downwards, bearing on their under surfaces immense quantities of earth and detached rocks. The floating ice met with in such large quantities is the result of the breaking up of the detached table-topped crags, and from the face of the cliffs, and not on the

* Athenæum.

surface of the sea, which maintained a comparatively high temperature. This high temperature was brought by the S.E. current previously alluded to as setting from the southern portions of the south connecting current, and the rates and duration of which were inferred from the examples cited at from ten to twenty-five miles per day. Arriving at the face of the icy barrier this current was lost, close under it there being but little movement felt; what there was being a drift to the *westward*,—a circumstance similar to what has been related north of Siberia. On the surface, then, no outlet is appreciable for the waters, but the drifting of the immense tabular bergs, immersed 800 feet, and rising 200 feet out of the water, was a proof of a northern or rather a north-easterly set, which by different observations was considered to move from twelve to eighteen miles per day when free from the barrier. The zone of equal temperature of the ocean, 39°·5, was observed by Capt. Sir James Ross to encircle the South Pole in a mean latitude of 56° 26′ S. On this circle the temperature was the same from the surface to the bottom, and was connected with these surface and subsurface currents moving in opposing directions. The icebergs and drift ice being thus transported into more temperate climates disappear, and the north-east drift adds its share to the eastward currents, which strike the western shores of Patagonia, and then turning northward form the Peruvian current, and against the west coast of Africa forming the cool south African current. In this manner the frigid influences of the antarctic climate were attempered, and brought into connexion with the other portions of the great world of waters, and illustrated that mighty system of ocean circulation everywhere evident in its effects on climate and the subject of meteorology in general. In the North Polar Sea a very different order of things exists: in many points a perfect contrast to those just described; but, as the subject was more familiar, it was not so largely entered into, the chief features only being selected. The fact of the Arctic Basin not being a sea of perpetual ice (or one solid mass of ice) was an evidence that it was pervious to the influences of more temperate climates; and that there being no old ice was a proof that means were at work for renewing it and dissipating the surplus of what the short summer does not dissolve. The current through Behring Strait,—an offset of that which the author first described, in 1851, as the Japanese current, similar in the Pacific to the Gulf Stream in the Atlantic,—was shown to be an unimportant northerly set through the narrow strait, and, therefore, was quite inadequate to produce any marked effect on the polar ices. The main body of warm water passed between Greenland, or rather Iceland, and Norway, and was an offset to the north-east of a portion of the Gulf Stream. The mode of this drift was explained by a diagram of the winds in lat. 47½° north, long. 32½° west, derived from Commander Maury's observations, but which showed some imperfections in the recording or arrangement. In this the great prevalence of the south-west over the north-east winds was clearly seen; and to this was owing the drift, which renders England and Iceland habitable, and enters the Arctic Basin, as has been described. The course of this stream was then traced step by step, eastward, till it emerged into Baffin's Bay or north of Greenland, between it and Spitzbergen, whence, passing southwards, it joined the southerly set down Baffin's Bay, across the banks of Newfoundland, transporting the deeply immersed bergs into the warm waters of the superficial Gulf Stream, and then, turning to the south-west, between the Gulf Stream and the coast, it was last at Cape Hatteras. In the north, then, as well as in the south, the circulatory system is apparent, and then each portion of the waters of the ocean visits, by turns, every portion of the earth. The fate of Sir John Franklin was next brought forward as a collateral subject. Mr. Findlay held that the statement, that two deserted and dismantled ships, seen on the ice on the north edge of the Newfoundland Banks on April 20, 1851, was quite possible, and that if true, of which he had no doubt, they were the unfortunate Erebus and Terror. The perfect consistency of the story as related by the different parties, and the improbability of any whaling ships remaining perfect for many years, led to the conclusion that they could be no other. Similar instances, as related by Dr. Scoresby, the parent of Arctic meteorology, of the drift of Sir James Ross, and of the Grinnell Expedition, might all be taken as evidences of the possibility of the statement. It was, therefore, believed that Franklin's track might be followed up the Wellington Channel from 1846 for one or two seasons; that, proceeding to the west or north-west, perhaps for 500 miles each step, he either got fixed in the main pack or else in some enclosed bay, like that of Capt. M'Clure as at present, and then deserting his ships, has not been able to reach any point where rescue was at hand; and that the ships, obeying the universal law, that all floating bodies within the Polar Basin must come out, drifted by the ocean currents either through Smith's Sound, found clear by Capt. Inglefield in the succeeding spring, or round Greenland, and down between it and Iceland, reached, without any great chances of demolition, the spot where they were stated to have been seen. There is no difficulty in allowing all this, and in finding perfectly analogous cases; but the main point, the ultimate end of the unfortunate Expedition, it was thought, would ever remain shrouded in the most painful mystery, as the search had only just begun in the right direction, and the last ray of hope would be extinguished if the present Expeditions return without bringing any intelligence.

Mean Meteorological Results at Toronto during the Year 1854.

Read before the Canadian Institute, Saturday, 20th January, 1855, *by* J. B. Cherriman, M.A.

The mean temperature of the year 1854 has been above the average of 14 years by 0°·87, due chiefly to excess of heat in July and October, but reduced by a fall in December; the months form May to November were above their average temperatures; the rest, with the exception of March, below.

The year is the hottest on record, with the exception of 1846.

The hottest month was July, and the coldest February, which is in accordance with the normal march of the temperature; the *climatic difference* is 51°·4, which is 7°·9 above the average.

July was the hottest month ever recorded, being 5°·7 above its average temperature, and no less than 3°·6 above the next inferior, which was July 1850.

The hottest day was July 3d (81°·3), and the coldest January 28th (1°·6), the difference between these being 79°·7.

Thr greatest daily range occurred on July 4th, amounting to 44°·5, and the range on the whole year is 110°·0, between 99°·2 on the afternoon of August 24th, and —10°·8 on the morning of February 3d, the former being by 4°·9 the highest temperature ever recorded.

The deviations at particular times from the normal march of the temperature, as given by Col. Sabine from 12 years' observations, have been extremely numerous and excessive, there being no less than 46 instances where the temperature, at the hour of observation, deviated from the normal by more than twenty degrees; of these the greatest number (39) were in defect, and occurred mainly in January and December. The most extreme were at 10 P.M, December 19th, 31°·6 below, and at 2 P.M., August 24th, 25.°·7 above.

Among periods of days remarkable for continued deviation, are the following:—

From January 23d to 25th, inclusive, mean deviation	—16°·7
February 2d to 6th	—15°·4
March 13th to 16th	+13°·1
" 24th to 29th	—15°·4
September 5th to 6th	+16°·2
December 4th to 8th	—13°·5
" 18th to 22d	—20°·6

On the whole, the year presents a remarkable instance of conformity with Col. Sabine's law of "permanence in the mean annual temperature, combined with great variability during the year."

By an inspection of the thermic anomalies, it will be seen that only one month (July) has been above the temperature due to it from geographical position, all the rest being more or less below.

Arranging the year into the ordinary seasons, we find their mean temperatures to be—

	Winter (1853-54)	Spring.	Summer.	Autumn.
	23°·3 –	41°·3 –	68°·2 –	49°·1
Difference from averages of 14 yrs	—1°·6 –	+0°·4 –	+3°·2 –	+2°·4

The summer is the hottest recorded, and the autumn is only exceeded by that of 1846.

The thermic anomalies for the respective seasons are—

Winter —11°·2; Spring —8°·2; Summer +0°·9; Autumn —3°·7.

These anomalies, however, ought each to be increased by about one degree, to reduce them to the sea-level, and the summer will thus have been about 2° hotter, the remaining seasons still considerably colder than their geographical position requires; the year thus partly confirming, partly being an exception to Dove's conclusion that "the summers of North America are not warmer than is due to their latitude, while the winters are much colder."

The mean humidity of the year is ·79, having attained a maximum in February and a minimum in July. Complete saturation has only occurred four times—on January 12th, at 2 P.M.; February 13th, at 8 A.M.; March 2d, midnight; March 3d, at 6 A.M. The lowest humidity (·27) occurred on August 7th, at 2 P.M.

The extent of clouded sky on the average of the whole year is ·59, so that nearly three-fifths of the sky has been overcast on the mean of the whole. The clouds were least prevalent in July, most in December; and no less than seven months have been on the average more than half overcast.

The mean direction of the wind was from N. 42° W., with a mean velocity of 6·02 miles per hour, making the most windy year of the series of 8 years. In all the months except September and October, the velocity was in excess of the average, and in November and December particularly so.

The depth of rain fallen has been 27·76 inches, which is 3·58 inches less than the average: and if to this we add 4·95 inches for the amount of rain equivalent to the fall of 49·5 inches of snow, we have a total of 32·71 inches. The chief deficiency in the fall of rain occurred from August to December, the earlier part of the year having been in excess. As usual, the greatest depth fell in September, and the least in December The fall of rain was distributed over 114 days, and that of snow over 52, so that there have been 199 perfectly fair days, on which neither rain nor snow fell. Of these August enjoyed the most (26) and February the least (8).

The whole period of time during which rain was falling is 17·4 days, and snow, 8·4; so that, though the fall of rain and snow was distributed over 166 days, the total duration of the fall only amounts to 25·8 days.

Frost occurred in every month except June, July, and August, the latest in Spring being on May 22d, and the earliest in Autumn on September 21st. The last snow of Spring was on April 29th, and the first of Autumn on October 16th. Toronto-bay was clear of ice on April 8th, and frozen over on December 2d; being crossed on foot on the morning of the 8th, this being unusually early. Only a few days about 26th October gave ill-defined indications of the Indian summer.

The number of thunder-storms during the year has been 58, more numerous than usual. Of these none occurred in January and February, one in March; the number increasing up to 16 in July, and then again descending to none in December. The most violent occurred on April 25th and 26th, May 17th and 20th, July 4th and 8th, from 19th to 22d, August 13th, and September 6th. That of July 4th was a complete hurricane, the wind for some minutes reaching a velocity of 60 miles per hour.

During the year there have been 203 nights the state of which would have permitted Aurora to be seen if it existed. On 55 of them Aurora was actually observed. Only two displays of the first magnitude occurred, on March 27th and April 10th, both accompanied by great magnetic disturbance. On July 10th and September 10th perfect Auroral arches were formed, but without active features.

Education in Scotland.—From a parliamentary paper recently issued, it appears that there are in Scotland 4,984 schools, whereof 1,138 are burgh or parochial schools, 2,104 endowed (other than burgh or parochial) schools, 1,567 adventure schools, and 175 charity schools. The burgh or parochial schools have 1,342 teachers, and educate 85.190 scholars, of whom 10,257 are educated gratuitously; the endowed schools, with 3,265 teachers, educate 175,031 scholars (20,362 gratuitously); and the adventure schools, with 2,150 teachers, educate 87,660 scholars, of whom 2,173 are gratuitously educated; and the charity schools, with 284 teachers, educate 16,600, all gratuitously, with the exception of about 300 children, who make some slight payment. The total number of teachers is 7,041; of scholars, 364,481; and of gratuitously educated children, 49,100. The total salaries and incomes of these schools amount to 271,641*l.* 13*s.* 2*d.*, of which burgh or parochial schools have 78,382*l.* 3*s.* 6*d.*; the endowed, other than burgh or parochial schools, 117,844*l.* 15*s.* 2*d.*; the adventure schools, 64,621*l.* 1*s.* 6*d.*; and the charity schools, 10,793*l.* 13*s.*

General Meteorological Register for the Year 1854. Provincial Magnetical Observatory, Toronto, C.W.

Latitude 43° 39′ 4 *North ; Longitude* 79° 21′·5 *West. Elevation above Lake Ontario.* 108 *feet. Approximate elevation above the sea,* 342 *feet.*

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sep.	Oct.	Nov.	Dec.	Year 1854.	Year 1853.
Mean Temperature	23°.57	21°.09	30°.68	41°.04	52°.20	64°.12	72°.47	68°.03	61°.04	49°.52	36°.84	21°.88	45°.21	44°.78
Difference from Average (14 years)	—1.16	—2.20	+0.39	—0.15	+0.97	+2.53	+5.68	+1.56	+2.75	+4.30	+0.15	—4.42	+0.87	+0.44
Thermic Anomaly (Lat. 43°-40′ N.	—9.2	—13.6	—9.4	—9.2	—5.9	—0.5	+3.8	—0.5	—0.5	—4.3	—6.4	—14.2	—5.8	—6.2
Highest Temperature	46.4	42.8	55.1	65.1	71.4	92.5	98.0	99.2	93.6	75.4	55.4	44.8		
Lowest Temperature	—5.4	—10.8	7.4	20.2	25.2	35.2	42.5	45.6	35.8	26.4	13.8	—7.0		
Monthly Range	51.8	53.6	47.7	44.9	46.2	57.3	55.5	53.6	57.8	49.0	41.6	51.8	50.90	48.47
Mean Maximum Temperature	29.31	29.62	36.32	47.82	61.82	74.50	84.79	80.72	72.59	58.97	42.08	29.46		
Mean Minimum Temperature	13.53	9.15	22.94	30.69	37.90	49.84	58.46	55.26	49.09	41.32	28.13	14.38		
Mean Daily Range	15.78	20.47	13 38	17.13	23.92	24.66	26.33	25.46	23.50	17.65	13.94	15.08	19.77	16.89
Greatest Daily Range	39.6	37.1	27.1	35.4	32.2	41.8	44.5	38.4	35.9	27.4	29.1	31.2		
Mean Height of Barometer	29.6067	29.6947	29.5246	29.6379	29.5661	29.5514	29.6403	29.6477	29.7008	29.6955	29.4392	29.5873	29.6077	29.6299
Difference from Average (12 years)	—.0231	+.0822	—.1068	+.0308	—.0174	—.0304	+.0430	+.0116	+.0467	+.0557	—.1796	—.0590	—.0122	+.0100
Highest Barometer	30.219	30.172	30.098	30.233	29.986	29.955	29.885	29.845	30.142	30.121	30.196	30.245		
Lowest Barometer	28.693	29.002	28.788	29.045	29.066	29.287	29.308	29.384	29.302	28.731	28.685	28.917		
Monthly Range	1.526	1.170	1.310	1.188	0.920	0.668	0.577	0.461	0.840	1.390	1.511	1.328	1.074	0.986
Mean Humidity	.84	.86	.85	.80	.74	.74	.71	.72	.79	.80	.80	.80	.79	.79
Mean Elasticity of aqueous Vapour	0.122	0.110	0.156	0.207	0.288	0.434	0.550	0.478	0.430	0.287	0.180	0.109	0.279	0.271
Mean Direction of the Wind	W. 12° N.	N. 7° E.	W. 40° N.	E. 37° N.	E. 24° S.	N. 10° E.	W. 32° S.	W. 28° N.	N. 18° W.	N. 25° E.	W. 1° S.	W. 43° N.	N. 42° W.	N. 38° W.
Mean Velocity (miles per hour)	6.86	6.91	8.02	6.82	5.38	4.12	4.26	4.74	4.31	4.60	7.58	8.66	6.02	5.08
Difference from Average (8 years)	+0.16	+0.13	+1.43	+0.13	+0.03	+0.02	+0.20	+0.48	—0.47	—0.09	+2.09	+2.26	+0.53	—0.33
Mean of Cloudiness	0.78	0.71	0.62	0.63	0.38	0.49	0.35	0.44	0.47	0.65	0.75	0.79	0.59	0.57
Total Amount of Rain (inches)	1.270	1.460	2.425	2.685	4.630	1.460	4.805	0.455	5.375	1.495	1.115	0.590	27.765	23.550
Difference from Average (14 years)	—0.515	+0.421	+0.803	+0.077	+1.628	—1.514	+1.053	—2.354	+0.998	—1.465	—1.799	—0.909	—3.576	—8.076
No. of Days Rain	7	5	9	12	11	9	9	5	14	15	13	5	114	109
Total Amount of Snow (inches)	7.5	18.0	2.8	2.7	Inapp.					Inapp.	1.3	17.2	49.5	53,2
Difference from Average (12 years)	—5.0	+0.0	—6.4	+0.7						—1.2	—1.2	+4.2	—8.9	—6.1
No. of Days Snow	11	15	3	4						3	4	12	52	52
No. of Fair Days	13	8	19	14	20	21	22	26	16	13	13	14	199	204
No. of Auroras Observed	3	4	12	8	6	2	4	1	6	5	3	1	52	57

On the Cause of the Aurora Borealis.

BY PROF. A. DE LA RIVE.*

(*Continued from page* 124.)

Agreement of the theory with the facts.

We have remarked that all observers agree now in regarding the aurora as an atmospheric phenomenon, and we have cited facts in support of this view. One more fact may be alluded to here which places it beyond doubt; it is from the observations on the aurora borealis published in the history of the Voyage of Captain Franklin. Lieutenant Hood and Dr. Richardson were 55 miles apart for the purpose of making simultaneous observations, in order to ascertain the parallax of the phenomenon and consequently its height. The result from three trials place it alike at a height of 6 to 7 miles. On the 2nd of April, at the most northerly station a brilliant arc was seen 10° above the horizon; at the other station, it was not visible. The 6th of August the aurora was at the zenith at one station, and 9° in height at the other. On the 7th of April it was again in the zenith at the first station, and 9° to 11° in height at the second.

Again, Hansteen, and after him, MM. Lottin and Bravais, were led to believe as a consequence of their observations, that the arc of the aurora is a luminous ring whose different parts are sensibly equidistant from the earth, and which is centered around the magnetic pole so as to cut at a right angle all the magnetic meridians which converge towards this pole. Such a ring is the auroral arch and its *apparent* summit is necessarily in the magnetic meridian of the place. M. Bravais also observes that the arc seems to have a kind of movement of rotation from the west to the east passing by the south. From this description the phenomenon is quite similar to the result of the experiment described above, and the direction of the rotation in the luminous ring is precisely that which ought to take place according to the laws governing the mutual action of currents, if it be the positive electricity which passes from the atmosphere to the surface of the earth, thence to penetrate about the north magnetic pole, reunite with the negative electricity, and thus constitute the current.

The diameter of the luminous ring will be greater, as the magnetic pole is more distant from the earth's surface, since this pole ought to be found in the intersection of the plane of the ring with the axis of the terrestrial globe.

It hence results that each observer sees the summit of the auroral arc in his own magnetic meridian; and hence only those on the same magnetic meridian see the same summit, and can take simultaneous observations for ascertaining the height.

If the summit of the arc pass the zenith of the observer, he is surrounded on all sides by the matter of the aurora, or the auroral influences which proceed from the earth, and then, if at all, the crackling sound which has been alluded to should be heard. If it does not reach the zenith, the observer is then outside of the region; and the aurora is more or less distant according to its altitude. The noise may be produced by the action of a powerful magnetic pole on luminous electric jets very near this pole, as I have proved by experiment; I have succeeded in producing a similar sound by bringing a piece of iron, strongly magnetised, to the luminous arch formed between the poles of a voltaic battery.

As to the sulphurous odor, it proceeds like that which accompanies lightning, from the conversion of the oxygen of the air into ozone by electric discharges.

The light of the aurora is not polarized, as was remarked by Biot in 1817, from his observations at the Shetland Islands. This negative result is confirmed by Mr. Macquorn Rankine, who has shown that this absence of polarisation is not due to the feebleness of the light, since this same light viewed after reflection from water is found to be polarised by this reflection. The most careful study and experiment have found no trace of polarisation in electric light, whether the discharges be made in the air or in a vacuum. This is a new proof of the identity of these two kinds of phenomena.

Finally, we discover in the resemblance between auroral appearances and certain clouds as well as the disturbances of the magnetic needle, a further important confirmation of our theory.

The observations of Dr. Richardson already mentioned, which show that the aurora exists at moderate elevations, also indicate that it is often connected with the formation of different kinds of *cirro-stratus* clouds. Lieutenant Hood, in speaking of the luminous bands or columns of the aurora, says that he is convinced that they are carried by the wind, because they retain exactly their relative situation, which is not the case when the luminous matter moves in the air by its own direct action. Finally, the coëxistence of the aurora with small ice needles in the atmosphere, such as exist in elevated clouds, is shown by Captain Richardson, who having seen at a temperature near — 32° C. (— 35° F.) an aurora whose superior arc was near the zenith, remarked that although the sky appeared perfectly serene during the phenomenon, there fell a fine snow hardly perceptible to the eye, though easily observed as it fell on the hand and melted. The same fact had been previously observed in full sunshine, the rays of the sun rendering the floating particles of ice visible.

Observers are agreed with regard to the existence of a stratum or dark segment, which rests in the northern horizon, and appears to be the source of the auroral display. The numerous observations of M. Struve at Dorpat, and those of M. Argelander at Abo confirm this apppearance. It is like a veil, which although permitting the light to pass gives the sky a more sombre aspect; moreover it is borded by a luminous arc. The existence of such a dark segment is confirmed by an observation of Gisler, who says that in Sweden, upon the high mountains, the traveller is sometimes suddenly enveloped in a very transparent mist of a grayish white colour, verging towards green, which rises from the soil, and is changed into the aurora borealis.

The *cirro-cumulus* and the mists become luminons when they are traversed by electric discharges sufficiently energetic, provided daylight does not efface the feeble light. They may sometimes be detected in the day: thus Arago establishes most incontestably that Dr. H. Usher was not deceived in a notice published in volume II. of the memoirs of the Irish Academy, where he describes an aurora seen at mid-day, on the 24th of May, 1788. This observer, during the day after a night in which he had witnessed a brilliant aurora, having observed an oscillation of the stars as seen with his lens, perceived in the sky rays of a white quivering light which rose from all points in the horizon towards the pole of the dipping needle, where they formed a light and whitish corona like that which the most

* Mem. Soc. de Phys. et Hist. Nat. de Genève, xii,, and Bib. Univ., xxiv, 337, Dec, 1853.

brilliant aurora presents at night. Arago, on consulting old records at the observatory, found that there were considerable magnetic disturbances that day in the magnetic needle kept for showing the diurnal variation, thus proving beyond question that the phenomenon observed by Dr. Usher was a veritable day aurora.

I find also in the account of the voyage of the Venus by M. de Tessan, that M. Cornulier, an intelligent officer in the French Navy, often observed on the coast of New Holland a particular direction in the cirrus clouds during the day, from which he was enabled always to announce a fine aurora australis at night. M. Cornulier, like M. Verdier, was convinced, from a study of the arrangement of the cirrus clouds, that in those reigons, auroras occur during nearly every day, and that the variation is only as to their brightness; they are often hid from view by clouds and storms. This remark agrees with the observations made under the direction of Captain Lefroy in Canada, at 13 different stations, and with others, collected by the Smithsonian Institution. It results from all these observations, that the aurora was seen on almost all clear nights, when the moon was not too bright, although not at all the stations. This is especially true during the months when the nights are longest. From October to March, there is scarcely a night without a visible aurora; and they are most brilliant in the month of February. The tables show that auroras were seen during 261 nights in 1850, and 207 in 1851. It is also remarkable and natural, that the auroras should have been seen most frequently in the stations nearest the magnetic pole.

Recurring to the coëxistence of icy particles in the air with the auroras, we find striking proof on this point in the Canada observations. The tables give with exactness the weather before and after the auroras. The aurora was almost always preceded by a fall of rain or snow; it also often happened that a fall of one or the other succeeded the aurora. The appearance of lunar halos, a common prelude to auroras, is a proof of the presence in the atmosphere of these icy particles which make up the network illuminated by the electric current.

But the most important proof of the electrical origin of the aurora is that derived from its action on the magnetic needle. The observations by Arago at the observatory of Paris,* by Forster, Farquharson, and by all voyagers, establish the following conclusions:—

1. During the day preceding the night on which an aurora appears, the declination of the magnetic needle to the west is always augmented 10, 20 or 30 minutes, or more.

2 On the contrary, at the middle, and at the end of the exhibition, the needle deviates from its normal state to the east.

3. Finally, the needle often undergoes irregular perturbations during an aurora, amounting to several minutes.

It happens ordinarily that the maximum deviation of the needle during the day preceding the night of the aurora, is at noon, or half an hour after noon; and the deviation due to the disturbance may be 5 to 30 minutes or more, beyond that of the days before or following. Sometimes the maximum western deviation is at other hours in the morning, and it is probable that in such cases there is an aurora during the day. Arago cites several cases of this kind. Thus, on the 17th of August, 1828, the declination from 8½h. A.M. till noon was 5′ above the mean of the month for the same hours; and on the same day, at 10h. P.M., Messrs. Coldstream and Foggo perceived feeble traces of an aurora which was probably the end of a day aurora. During the evening the needle was in its ordinary position.

The magnetic observation made in the regions near the pole confirm the influence on the needle. Thus at Reykinwik (64° 8′ 15″ N.) MM. Lottin and Bravais, having made numerous observations on the diurnal variation of the needle parallel with similar observations at Paris and Cherbourg, were struck with the almost continual disturbance of the needle. They at first attributed it to some movement in the earth: but afterwards, remarking the concordance of their observations with those of M. de Löwenörn made in 1786, 50 years before, they satisfied themselves that the effect was due to auroras invisible to them because of the continued presence of the sun above the horizon. M. Ginge, a Danish Missionary, made observations in 1786, 1787, continued through the 24 hours, which showed that the western declination was ordinarily strongest from 9 to 10 in the evening, and least at 9 to 10 in the morning, a fact which he attributed without hesitation to the aurora. This conclusion it confirmed by the very numerous and excellent observations of MM. Lottin and Bravais.

We thus see, that for a long period observations near the pole have shown that auroras must be more frequent than was supposed, and this is confirmed by the facts observed in Canada and the United States.

We therefore conclude, that the production of auroras, northern and southern, is the normal mode of neutralising the positive electricity of the atmosphere with the negative of the earth. This neutralisation should not take place in a manner very uniform or regular. It is evident that the variations in the mists or conducting capabilities of the atmosphere will be attended by variations in the facility of this neutralisation.

These differences will be evinced by the deviations or disturbances of the magnetic needle, which will be sensible at great distances from the poles, as in the temperate zone where they are often observed. The western deviation which in the middle latitudes usually precedes an aurora, indicates a large accumulation of electricity, due to a powerful condensation of vapours in the polar regions, which by facilitating the reunion of the two electricities, augment, the intensity of the terrestrial current passing in our hemisphere from the equator to the north, and consequently carries the needle more to the west. When the aurora is once visible, the current becomes less strong, because the light itself of the aurora is proof of the resistence (probably due to the congelation of the particles of water suspended in the air that constitutes the mist) which the reunion of the two electricities encounters;* the needle will then retrograde to the east, as actually takes place.

In the higher latitudes, the disturbances of the needle are continual, because the slightest differences in the intensity of the electric discharges that take place in the polar regions should be there perceived. As to the observations of MM. Ginge, Löwenörn and Lottin, that the maximum deviation of the needle takes place from 8 to 10 o'clock in the evening, and the minimum at 9 to 10 in the morning, they were made only during some weeks in summer, and they prove only that at this season of the year, the greatest amount of condensation of

* Ann. de Ch. et de Phys., x. 120; xxx, 423; xxxvi, 398; xxxix, 369; xlii, 351; xlv, 403.

* It is clear that the mist when first formed should be a better conductor than when, afterwards, it consists only of icy particles.

moisture take place, as should be the case, at times just preceding and following the setting of the sun, and at least 7 or 8 hours after its rising. In the observations of Lieutenant Hood, made in the voyage of Captain Franklin, between the 1st of February and the 31st of May, the greatest declination took place at 8 and 9 o'clock in the morning, and the least at an hour after noon. Thus, as is seen, the times of the maxima and minima are widely variable in those high latitudes, where there are great differences in the length of the day, and also in temperature, and therefore considerable electric disturbances of the air.

It is a singular fact, sometimes noticed, that when an observer is in the midst of an aurora, so to speak, the action on the needle may be null. This was remarked by Mr. Forster, at Port Bowen, beyond 65° N., the latitude of Forts Franklin and Enterprise, where Dr. Richardson had on the contrary observed the action of the needle. In fact, a needle in the interior of the circle formed by the aurora about the magnetic pole, is no longer under the influence of the currents which circulate around it and not above or below, and it ought therefore to experience only a variable and irregular action.

I have said that the aurora was probably of daily occurrence, and varied only in intensity. These differences in intensity are the reason for its being not always perceptible, and also for its less frequency remote from the magnetic poles. As to the differences of number for each month, they are attributable to two causes—but especially to the unequal length of the nights, for there should be fewer in the shorter nights. Thus in May, June and July the fewest are seen, because the days are the longest, while in the nine others, and especially in March, September and October, they are most numerous. This preëminence of these three months above others, of still shorter days, can be due only to this, that the auroras are most frequent at the times of the equinoxes, and especially the autumnal equinox. This is readily understood if we consider that the vernal equinox is the time when the sun transfers to the northern hemisphere its powerful influence either direct or indirect in the developement of electricity; and that the autumnal should be followed with a large condensation of the vapours accumulated in the atmosphere during the months of summer—a condensation which, as already explained, facilitates the neutralisation of the two electricities, developed in large quantities during the summer, and augments consequently the intensity of the discharge at the pole.

It has been pretended that in the appearances of the aurora borealis there are secular variations; in other words, that there are epochs comprising a certain number of years during which auroras are particularly frequent, and others in which they are rare. This opinion does not appear to me to be based on documents sufficiently exact to be admitted. There may be a difference in different years, as there is a difference in temperature and humidity. But this is far from making out a periodicity in auroras: to establish such a periodicity, there ought to be the collected observations of a century, from observers at least as good, and as favourably situated with reference to the magnetic poles, as those now engaged: and this we have not. We need not therefore dwell longer on this point, only remarking that if really such a periodicity exists, it might be connected with the change in the magnetic poles, which are the centers of the aurora, and which according to the surface about them would more or less facilitate the electric circulation; for it is evident that the naked soil would afford more ready circulation than a surface covered with a great thickness of ice. But, I repeat it, the fact of the periodicity is far from proved.

Recapitulation.—1. All observations agree in demonstrating that the aurora borealis is a phenomenon taking place in our atmosphere, and that it consists in the production of a luminous ring whose centre is the magnetic pole, and having a diameter more or less large.

2. Experiment demonstrates that in causing in highly rarified air the reunion of the two electricities near the pole of an artificial magnet, a small ring of light is produced similar to that which constitutes the aurora, and having a like movement of rotation.

3. The aurora is consequently due to electric discharges taking place in the upper regions between the positive electricity of the atmosphere and the negative electricity of the earth—the electricities being separated by the direct or indirect action of the sun, principally in the equatorial regions.

4. As these electric discharges take place constantly, though with varying intensity, depending on the state of the atmosphere, the aurora should be a daily phenomenon, more or less intense, and consequently visible at greater or less distances, and only when the night is clear—which accords precisely with observation.

5. The phenomena that attend the aurora, such as the presence and form of the *cirro-stratus* clouds, and especially the disturbances of the magnetic needle, are of a kind to demonstrate the truth of the electric origin attributed by the author to the aurora—an hypothesis with which these phenomena correspond even in their minutest details.

6. The aurora australis, according to the few observations on it which have been made, presents exactly the same phenomena as the aurora borealis, and is explained in the same manner.

Result of the Astronomer Royal's Recent Pendulum Experiments; Harton Pit, South Shields.

Addressed by Professor Airey to Mr. James Mather.

Royal Observatory, Greenwich, Dec. 2, 1854.

MY DEAR SIR,—It will be, I am sure, matter of satisfaction to you to know that the result of the computations of the pendulum vibrations gives the highest confidence in the certainty of the results to be deduced from them. The comparison of the rates of the pendulums before and after their interchanges shows, that there is no evidence of their having undergone any mechanical change whatever, and almost positive evidence against their having undergone any change amounting, in its effect on their vibrations, to 1-20th part of a vibration in a day. The immediate result of the computations is this, supposing that a clock was adjusted to go true time at the top of the mine, it would gain 2¼ seconds per day at the bottom. Or it may be stated thus, that gravity is greater at the bottom of the mine than at the top by 1-19190th part. To go a little further into the interpretation. If there had been no coal measures or rocks of any kind between the top and the bottom, but merely an imaginary stand to support the pendulums, the gravity at the top *would have been* less than at the bottom by 1-8400th part nearly. But it *is* less by only 1-19200th part. And what is the cause of the difference? It is the attraction of the shell of matter, whose thickness is included between the

top and the bottom of the mine. The attraction of that shell, therefore, is the difference between the two numbers which I have given, or is 1-14900th part of gravity nearly. But if that shell had been as dense as the earth generally, its attraction would have been 1-5600th part of gravity nearly. Therefore the earth generally is more dense than the coal measures in the proportion of 149 to 56 nearly. You will remark that all these numbers are rough, and to make their results available, some small corrections are required (to which I have not alluded) and some knowledge of the density of the different beds, &c., which I do not possess at present.

I am, my dear Sir,
Yours, very truly,
G. P. AIREY.

The Late John Lockhart.

The hand of death, though most conspicious of late in the battle-field, has not been idle in the walks of science and literature. Some, indeed of the men of note whom we have recently lost are of so great eminence that we look around among the rising generation with something like despair to find any capable of filling the gaps which have been left.

Such a one was John Gibson Lockhart, the biographer and son-in-law of Sir Walter Scott, who now lies in the same grave with him at Dryburgh. Mr. Lockhart was the second surviving son of a Scotch clergyman, of gentle descent and old family, in the county of Lanark. He was born, 1794, in the manse of Cambusnethen, whence his father was transferred, 1796, to Glasgow, where John Lockhart was reared and educated. The inheritance of genius (as in many other instances) would appear to have come from his mother, who had some of the blood of the Erskines in her veins. His appetite for reading, even as a boy, was great. Though somewhat idle as regards school study, he yet distinguished himself both at school and college, outstripping his more studious competitors, and finally obtaining, by the unanimous award of the Professors, the Snell Exhibition to Baliol College Oxford, where he was entered, 1809, at the early age of 15. Dr. Jenkyns, the present Dean of Wells, was his tutor. Before leaving the University he took honours as a first-class man. After a sojourn in Germany sufficiently long to enable him to acquire its language and a taste for its literature, he was called to the Scottish bar in 1816; but though endowed with perseverance and acuteness sufficient to constitute a first-rate lawyer, he wanted the gift of eloquence to enable him to shine as an advocate. As he natively confessed to a party of friends assembled to bid him farewell on his departure from Scotland for London, "You know as well as I that if I had ever been able to make a speech there would have been no cause for our present meeting." His wit, his learning, and extensive reading found, however, a ready outlet through the pen. In 1818 Lockhart was introduced to Scott, who in 1820 evinced his esteem and affection for him by giving him in marriage his eldest daughter. At Scott's death in 1832 he was left sole literary executor. Many of the cleverest things in *Blackwood's Magazine* (established in 1817) were written by Lockhart in concert with his friends John Wilson, Capt. Hamilton, Hogg, &c., and much ill-blood was caused among the Whigs, who from assailants, now began to be assailed by opponents of no mean skill in fence. Party warfare then ran high in Edinburgh; much ill-blood was engendered. Unfortunately, the strife was not confined to squibs, and at least one fatal catastrophe was the result. These events left a lasting impression on Lockhart's mind, and when, in 1826, he was invited to become editor of the *Quarterly Review*, he quitted Edinburgh without regret, with his family, as he received from the Government of Sir Robert Peel and the Duke of Wellington the post of Auditor of the Duchy of Lancaster. The management of the *Quarterly Review*, to which he contributed many valued papers, chiefly biographical, continued in his hands for 28 years down to 1853, when his failing health compelled him to resign the labour. The latter years of his life were mournfully darkened by domestic calamity. The deaths in succession of his eldest boy—the pet of Sir Walter, the "Hugh Littlejohn" for whose instruction he wrote *Tales of a Grandfather*—of his wife, and all the other members of Sir Walter Scott's family, were followed and wound up by that of his only surviving son, under circumstances of poignant grief to a father's heart. The vials of sorrow seemed to have been emptied upon his head. With broken health and spirits he betook himself to Rome, by medical advice, with slight hope on his own part of benefit. Having little taste for foreign travel, he returned home in the spring of the present year. He made a partial rally on his arrival in Scotland, but a very severe attack of diarrhœa in the month of October shattered his already enfeebled frame; he was removed from Milton Lockhart, the house of his eldest brother, M.P. for Lanark, under the care of his old friend, Dr. Furgerson, to Abbotsford, where he breathed his last, on the 25th of November, in the arms of his daughter, the sole survivor of the line of Scott in the second generation.—*Evening Mail.*

On the Re-Cutting of the Koh-i-Noor Diamond.

BY PROF. J. TENNANT.

At the meeting of the British Association at Belfast, the author gave some account of this diamond, and described some of the remarkable changes which it had undergone, and on this occasion exhibited some interesting diagrams illustrating the crystalline form and cleavage of the diamond. Mr. Tennant now introduced the subject by drawing attention to the former weight of the diamond, compared with its present bulk, now reduced by cutting; and also to its mineralogical appearances. With regard to the history of this extraordinary gem, he stated that some people had actually disputed its authenticity, which caused some discussion amongst those best informed in matters of this description. At the Great Exhibition in 1851, an opportunity had been afforded, such as was never previously enjoyed by the public, of studying the substance of a vast number of foreign valuable stones, and probably of Koh-i-Noor diamond was the most attractive in that valuable collection. The rough manner in which that diamond had been cut, however, had disappointed many who looked upon it. When the sun shone on it at noon-day the stone appeared peculiarly brilliant, but when the atmosphere was dull, it had merely the appearance of a thick piece of glass. This placed it in a very unfavourable position, and caused doubts to arise in the minds of some gentlemen as to its authenticity. This diamond origiually belonged to Runjeet Singh, who usually wore it upon his left arm, according to the custom of Eastern potentates; and the original mounting was now in the hands of Her Majesty's jewellers. The stone perfectly agreed with the drawing which had been made of it by Miss Eden, and also of the account given of it by the Hon. W. G. Osborne, who had published a very interesting description of the Court of Runjeet Singh, where the old man (who was blind and a cripple also) sat arrayed in a robe of simple white, wearing upon his arm the Koh-i-Noor diamond, and surrounded by his eastern nobles. On special occasions, Runjeet Singh was in the habit of decorating his horse with this precious gem, together with numerous other valuable stones, mounted upon various parts of his harness. All authentic accounts of the East proved that the nobles were in the habit of decorating their horses in this manner; and the horse of Runjeet Singh was decorated with diamonds valued at £300,000, the great Koh-i-Noor being placed on the pummel of the saddle. Lord Auckland and his sister, the Hon. Miss Eden, had this diamond sent to them for inspection, in the East Indies, and Miss Eden's drawings agreed with the appearance of the diamond on its arrival in this country Mr. Tennant stated that in 1853 he had given in a report as to the cutting of the Koh-i-Noor diamond; and after producing various models, Her Majesty fixed upon the present form, by which the widest spread of brilliancy was obtained. When the diamond was exhibited at the Crystal Palace it weighed 186 1-16 carats; its present weight, reduced by cutting, was 102 13-16 carats. The Persian diamond weighed 130 carats, and the great Russian diamond 193 carats. After giving a description of the method of cutting diamonds, and the plan adopted for cutting the Koh-i-Noor, he observed that the late Duke of Wellington had been an interested spectator of the operation, and was a frequent visitor during its progress. It was finished in September, 1852, and occupied thirty-eight days in cutting. Diamonds were usually reduced to one-half their weight in cutting; and he gave the exact weight of the Koh-i-Noor, in order to correct various erroneous statements which had been published on the subject. The finest diamond in France weighed 139 carats, and had cost £130,000; it was called the Regent, or Pitt diamond. To arrive at an estimate of the valne of the Koh-i-Noor the author stated, that it was only requisite to multiply 102 (its weight) by 102, and then by 8, which would give £83,-232 as its value. This rule would not apply to stones having defects, as instanced in the celebrated "Nassuck" diamond, for which the East India Company refused £30,000, and yet this stone when

submitted to public auction, fetched little more than £7,000. The Koh-i-Noor is of the purest water. The author stated, that in order to test a real diamond, and distinguish between that of a topaz, it was necessary to scratch it with sapphire (No. 9 in hardness), which would mark a topaz, but would not penetrate a diamond. He was sorry to find that so little attention had been paid to the means of testing diamonds; and instanced a ring which was recently purchased in Regent Street, London, for £200, which proved to be two pieces of rock crystal, with an intermediate insertion of coloured glass. In many of our watering-places the gentry were imposed upon by parties selling pieces of glass, which they represented to be sapphires picked up on the beach.—*Athenæum.*

Surrender of the Saugeen Peninsula.

The last surrender of any considerable tract of fertile land which can take place in Western Canada is recorded in the treaty which follows. Mere isolated patches, few and far between, now remain in possession of the miserable remnants of the sons of the soil. The treaty was concluded in October last, and opens a beautiful but rather distant and inaccessible region to the adventurous settler.

Treaty Recording the Surrender of the Saugeen Peninsula.

We, the Chief-Sachems and principle men of the Indian tribes residents at Saugeen and Owen Sound, confiding in the wisdom and protecting care of our Great Mother across the Big Lake, and believing that our Good Father, His Excellency the Earl of Elgin and Kincardine, Governor General of Canada, is anxiously desirous to promote those interests which will most largely conduce to the welfare of His Red children, have now, being in full Council assembled in presence of the Superintendent General of Indian Affairs, and of the young men of both tribes, agreed that it will be highly desirable for us to make a full and complete surrender unto the Crown of that Peninsula, known as the Saugeen and Owen Sound Indian Reserve, subject to certain restrictions and reservations to be hereinafter set forth. We have therefore set our marks on this document, after having heard the same read to us, and do hereby surrender the whole of the above named tract of country bound on the south by a straight line from the Indian Village of Saugeen, to the Indian Village of Nawash, in continuation of the Northern limit of the narrow strip recently surrendered by us to the Crown, and bounded on the North-east and West by Georgian Bay and Lake Huron, with the following reservations to wit:

1st.—For the benefit of the Saugeen Indians, we reserve all that block of land bounded on the West, by a straight line running due North from the River Saugeen at the spot where it is entered by a ravine, immediately to the west of the village, and over which a bridge has recently been constructed to the shore of Lake Huron:—on the South by the aforesaid northern limit of the lately surrendered strip; —on the East by a line drawn from a spot upon the coast at a distance of about nine miles and-a-half from the Western boundary aforesaid, and running parallel thereto until it touches the aforementioned northern limit of the recently surrendered strip, and we wish it to be clearly understood, that we wish the Peninsula at the mouth of the Saugeen River, to the west of the western boundary aforesaid, to be laid out in town and park lots and sold for our benefit without delay, and we also wish it to be understood that our surrender includes that parcel of land which is in continuation of the strip recently surrendered, to Saugeen River.

We do also reserve to ourselves that tract of land called Chief's Point, bounded on the East by a line drawn from a spot half-a-mile up the Sable River, and continued in a northerly dirrection to the Bay, and upon all other sides by the Lake.

2nd.—We reserve, for the benefit of the Owen Sound Indians, all that tract bounded on the South by the Northern limit of the continuation of strip recently surrendered on the North-west by a line drawn from the North-easterly angle of the aforesaid strip, (as it was surrendered in 1851,) in a North-easterly direction. On the South-east by the Sound, extending to the Southern limit of the Caughnawaga settlement;—on the North by a line two miles in length forming the said Southern limit, and we also reserve to ourselves all that tract of land called cape Crocker, bounded on three sides by Georgian Bay, on the South-west by a line drawn from the bottom of Nochemowenaing Bay, to the mouth of Sucker River, and we include in the aforesaid surrender the parcel of land contained in the continuation to Owen Sound of the recently surrendered strip aforesaid.

3rd.—We do reserve for the benefit of the Colpoy's Bay Indians in the presence and with the concurrence of John Beattie, who represents the tribes at this Council, a block of land containing 6000 acres and inclnding their village and bounded on the North by Colford's Bay.

All which reserves we hereby retain to ourselves and our children, in perpetuity, and it is agreed, that the interest of the principal sums arising out of the sale of our lands, be regularly paid to them, so long as there are Indians left to represent our tribe, without diminution, at half-yearly periods.

And we hereby reqnest the the sanction of our Great Father, the Governor General, to this surrender, which we consider highly conducive to our general interests.

Done in Council at Saugeen, this thirteenth day of October, 1854.
It is understood that no Islands are included in this surrender.
(Singed and sealed.)

L. Oliphant, Superintendent General Indian Affairs.
Peter Jacobs. Missionary.

(Witnesses.)
(Signed,)
John Ross, M.P.P.
C. Rankin, P.L.S., (seal.)
A. McNab, Crown Land Agent.

(Signed,) John Kadahgekwun, (seal.)
" Alexander Madwayosh, (seal.)
" John Monedaowab, (seal.)
" John Thos. Wabbahdick, (seal.)
" Peter Jones, (seal.)
" David Sawyer, (seal.)
" John H. Beatty, (seal,)
" Thomas Pababenosh, (seal.)
" John Madwashaninck, (seal.)
" John Johnston, (seal.)
" John Aunjegahbowin, (seal.)
" John Newash, (seal.)
" Thomas Wabbahdick, (seal.)
" Charles Keebick, (seal.)

Government Aid to Scientific and Literary Institutions, in Upper and Lower Canada.

Aid to	Canadian Institute, Toronto		£250	0	0
Do.	do.	towards their Building	500	0	0
Do.	the Literary and Historical Society at Quebec		50	0	0
Do.	do. for their Building and Library collection		200	0	0
Do.	Natural History Society at Montreal		50	0	0
Do.	do. for their collection		100	0	0
Do.	Mechanics' Institute at Quebec		50	0	0
Do.	do.	Montreal	50	0	0
Do.	do.	Kingston	50	0	0
Do.	do.	Toronto	50	0	0
Do.	do.	London, C.W.	50	0	0
Do.	do.	Niagara	50	0	0
Do.	do.	Hamilton	50	0	0
Do.	do.	Belleville	50	0	0
Do.	do.	Brockville	50	0	0
Do.	do.	Bytown	50	0	0
Do.	do.	Cobourg	50	0	0
Do.	do.	Perth	50	0	0
Do.	do.	Picton	50	0	0
Do.	do.	Guelph	50	0	0
Do.	do.	St. Thomas	50	0	0
Do.	do.	Brantford	50	0	0
Do.	do.	St. Catherines	50	0	0
Do,	do.	Goderich	50	0	0
Do.	do.	Whitby	50	0	0
Do.	do.	Three Rivers	50	0	0
Do.	do.	Berthier, L.C.	50	0	0
Do.	do.	Simcoe	50	0	0
Do.	do.	Woodstock	50	0	0
Do.	do.	County of Peel	50	0	0
Do.	do.	Port Sarnia	50	0	0
Do.	do.	Chatham	50	0	0
Do.	do.	County of Halton	50	0	0
Do.	do.	County of Ontario	50	0	0
Do.	do.	Port Hope	50	0	0

Aid to Mechanics' Institute at Stratford		£50	0	0
Do. do.	Peterborough	50	0	0
Do. do.	Iberville	50	0	0
Do. do.	Renfrew	50	0	0
Do. do.	Mitchell, County of Perth	50	0	0
Do. do.	Berlin	50	0	0
Do. do.	Fonthill	50	0	0
Do. do.	Dundas	50	0	0
Do. do.	Oakville	50	0	0
Do. do.	Waterdown	50	0	0
Do. the Canadiau Institute at Quebec		50	0	0
Do. the Athenæum at Toronto		100	0	0
Do. the Huron Library Association and Mechanics' Institute		50	0	0
Do. Teacher Association at Quebec, for their Library		50	0	0
Do. Library Association at Quebec		50	0	0
Do. National Institute at Montreal		50	0	0
Do. Canadian Institute at Montreal		50	0	0
Do. Canadian Institute, Bytown		50	0	0
Do. Mechanics' Institute, St. Hyacinthe		50	0	0
Do. do.	Sorel	50	0	0

CANADIAN INSTITUTE, SESSION 1854–55.

Third Ordinary Meeting--Saturday, January 6, 1855.

The names of the following Candidates for membership were read:—

Walter McKenzie, ...Toronto.
Paul Kane.. "
Francis Boyd.. "
Joseph Robertson.. "
Dr. Allan Cameron.. "

The following donation was announced:—

"Transactions of the Literary and Historical Society of Quebec," by E. M. Meredith, V. P. Lit. & His. Soc. Quebec.

The thanks of the Institute were ordered to be transmitted to Mr. Meredith.

The following gentlemen were elected members:—

W. M. Jamieson..Toronto.
Henry Turner, M.D..Galt.
E. Clarke, M.R.C.S..Toronto.
John Holland.. "

The Annual Address was delivered by the President.

Professor Wilson, LL.D. read a paper "On some Conchological relics of the Red Indians of Canada."

Several Conch shells, found in various parts of Western Canada, were exhibited by Dr. Wilson.

Fourth Ordinary Meeting--Saturday, January 13, 1855.

The name of the following Candidate for membership was read:—

William Glynn,..Toronto.

The following gentlemen were elected members:—

Walker McKenzie,..Toronto.
Paul Kane,.. "
Francis Boyd,.. "
Joseph Robertson,.. "
Dr. Allan Cameron,.. "

The following donations were announced:—

1. "The Annual Report of the Normal, Model, Grammar and Common Schools in Upper Canada:" from the Department of Public Instruction.
2. "Edicts &c., relative to the Seignorial Tenure of Lower Canada." "Titles and Documents relating to the Seignorial Tenure of Lower Canada." "Return relating to judicial officers in Lower Canada." "Relation Abrégée de quelques Missions des pères de la Compagnie de Jésus dans la Nouvelle France." From Thomas Henning.

The thanks of the meeting were voted to the Superintendant of Education for Upper Canada, and to Thomas Henning, for their respective donations.

The Rev. Professor Irving read a paper "On the Eclipse of May 26, 1854." by Professors Cherriman and Irving.

Professor Chapman communicated a "Note on Carbonate of Lime as an Igneous Product."

A specimen of native copper from Lake Superior, containing a well characterized impression of a crystal of carbonate of lime was exhibited.

A discussion on the subject of Professor Chapman's communication followed.

The Vice President announced that at the next meeting the following papers would be read:—

1st. On the object of the Salt Condition of the Sea, by Professor Chapman.

2nd. The general Meteorological Results for 1854, by Professor Cherriman.

Fifth Ordinary Meeting--Saturday, January 20, 1855.

The names of the following Candidates for membership were read:—

James Gilbert,..Toronto.
Secker Brough,.. "

The following donations were announced:—

Twenty-six volumes of "Bohn's *Classical*, *Ecclesiastical*, *Standard*, *Antiquarian*, *Philological*, *Illustrated* and *Scientific* Library," by H. G. Bohn, London; through A. H. Armour, Toronto.

The thanks of the Institute were directed to be transmitted to Mr. Bohn for his handsome donation.

The thanks of the Institute were also directed to be given to A. H. Armour.

The following is a list of the works included in Mr. Bohn's donation:—

Books presented by H. G. Bohn, Esq., to the Canadian Institute.

Cowper's Works, Vol. 4; conclusion of Memoir and Correspondence, with general index to the same,

Cowper's Works, Vols. 5 & 6; containing Poetical Works, complete in 2 vols., with 14 engravings on steel.

Hungary; its History and Revolutions: with a copious Memoir of Kossuth, from new and authentic sources. With fine Portrait of Kossuth.

History of Russia, from the earliest period to the present time, compiled from the most authentic sources, including Karamsin, Tooke, and Segur, by W. H. Kelly, vol. 1; with fine Portrait of Catharine the Second.

Locke's Philosophical Works; with general index and fine Portrait, vol. 2.

Defoe's Works, edited by Sir Walter Scott, Vol. 1; containing the Life, Adventure, and Piracies of Captain Singleton, and the Life of Colonel Jack.—Volume 2, containing Memoirs of a Cavalier, Adventures of Captain Carleton, Dickory Cronke, &c.

Gibbon's Roman Empire; Vols. 4 & 5: with fine Map of the Eastern Empire.

Prior's Life of Burke, new edition, revised by the Author; with fine Portrait.

Burke's Works, Vol. 1: containing his Vindication of Natural Society; Essay on the Sublime and Beautiful; and various Political Miscellanies.

The Elegies of Propertius, the Satyricon of Petronius Arbiter, and the Kisses of Johannes Secundus, literally translated, and accompanied by Poetical Versions, from various Sources; to which are added the Love Epistles of Aristocretus, translated by R. Brinsley Sheridan and H. Halhed. Edited by Walter H. Kelly.

The Geography of Strabo, translated, with copious notes, by W. Falconer, M.A., and H. C. Hamilton, Esq.; vol. 1.

Xenophon's Anabasis or Expedition of Cyrus, and Memorabilia, or Memoir of Socrates, translated with notes, by the Rev. J. S. Watson, M.A., and a Geographical commentary by W. F. Ainsworth, F.S.A., F.R.G.S., &c. Frontispiece.

Logic, or the Science of Inference, a popular Manual, by J. Davey.

India, Pictorial, Descriptive, and Historical, from the Earliest Times to the Present. Illustrated by upwards of one hundred fine engravings on wood, and map of Hindostan.

Nicolini's History of the Jesuits: their Origin, Progress, Doctrines, and Designs. With fine Portraits of Loyola, Laines, Xavier, Borgia, Acquavira, Père la Chaise, Ricci, and Pope Ganganelli.

Odericus Vitalis; his Ecclesiastical History of England and Normandy, translated with notes and the introduction of Guizot, by F. Forester, M.A.; vol. 3.

Matthew Paris's English Chronicle, translated by Dr. Giles: Vol. 3 completing the work, with index to the whole, including tho portion published under the name of Roger of Wendover.

Lamb's Specimens of English Dramatic Poets of the time of Elizabeth; including his Selections from the Garrick Plays.

Marco Polo's Travels, the Translation of Marsden, edited with notes and introduction, by T. Wright, M.A., F.S.A., &c.

Florence of Worcester's Chronicle, with the Two Continuations; comprising Annals of English History, from the Departure of the Roman's to tho Reign of Edward I. Translated, with Notes, by Thomas Forester, Esq.

Ennemoser's History of Magic, translated from the German by William Howitt; with an appendix of tho most remarkable and best authenticated Stories of Apparitions, Dreams, Second Sight, Predictions, Divinations, Vampires, Fairies, Table-turning, and Spirit-Rapping, &c. Selected by Mary Howitt; in two volumes.

The Works of Philo Judæus, translated from tho Greek, by C. D. Yonge, B.A.: vol. 1.

BOOKS FROM THE PUBLISHERS.

Lives of the Queen's of England before the Conquest, by Mrs. Matthew Hall. (Blanchard and Lea, Philadelphia.)

The American Almanac for 1855. (Phillips, Sampson & Co., Boston.)

The following gentleman was elected member :—

William Glynn,..Toronto.

Professor Chapman read a paper "On the Object of the Salt Condition of the Sea."

Professor Cherriman read a paper "On the Meteorological Results of 1854."

Tho discussion "On Carbonate of Lime as an Igneous Product;" with reference to Professor Chapman's note communicated at the preceding meeting, was renewed.

Sixth Ordinary Meeting--Saturday, January 27, 1855.

The names of the following Candidates for membership were read :—

Robert Bell,..Carleton Place.
Robert Grier,..Toronto.

The following gentlemen were elected members :—

James Gilbert, (Junior Member)........................Toronto.
Seeker Brough,.. "

A paper was read by James Bovell, M.D., "On the Transfusion of Milk, as practised in the Cholera Sheds at Toronto in 1854."

A communication was made by Professor Wilson, L.L.D, "On the use of Types and Printing amongst the Romans of the Second and Third Centuries."

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY OR STATED MEETING.

WEDNESDAY, 6TH DECEMBER, 1854.

The following donations were announced :—

Some ancient Roman Coins, from W. D. Campbell.

A communication was read by Wm, A. Hollwell, in continuation of his Paper on a "New Projectile," &c., read at the last stated meeting.

A committee was appointed to make experiments for the purpose of testing the value of Mr. Hollwell's Projectile, &c.

GENERAL MONTHLY MEETING.

WEDNESDAY, 13TH DECEMBER.

The following donations were announced from Robert Symes:

1. Specimen of Iron Ore from the ore bed of the Marmora Foundry Company.
2. Specimens of Iron Pyrites from the same locality.
3. Wild Rice from Rice Lake, Upper Canada.
4. Deer Horns in the velvet state, from Marmora.
5. Eggs of the large Mud Turtle (*Crow River*).
6. Axo used in Bonaparte's Kitchen at St. Helena.

Viscount Bury was elected an Associate Member of the Society.

STATED MEETING.

WEDNESDAY, 20TH DECEMBER.

A communication on the subject of education and Model Schools was read by Frederick Boxer.

E. A. MEREDITH, *Vice-President.*

MR. BOHN'S LIBRARIES.

We have frequently had the opportunity of recording the presentation of numerous volumes to the Library of the Canadian Institute by Mr. Bohn, the celebrated London Publisher of Literature for the People. By reference to tho proceedings of the Institute which appear in the present number of this journal, it will be seen that Mr, Bohn has again transmitted a valuable donation from England of twenty-six volumes of his *Standard Library, British Classics, Classical Library, Illustrated Library, Philological Library, Antiquarian Library, Scientific Library, and Ecclesiastical Library.*

Canadians have gradually become so accustomed to the cheap Literature of this country and the United States, to the reprints of Standard works as well as of the current European literature of the day, that

we are apt to forget that successful attempts have been made in England to furnish the public with the works of eminent authors, illustrated and got up in a very superior style, and at a price which places them within the reach of every reading man. Mr. Bohn is not the only British publisher of 'Literature for the People,' whose works are distributed in every quarter of the globe where the English language is spoken. It was only during the second quarter of the century that any serious attempts were made in Britain to furnish a Literature for the people. In 1825, Constable's Miscellany commenced at 3s. 6d. stg. a volume. In 1829, the Waverley Novels at 5s. a volume appeared; the *Family Library*, by Mr. Murray; *Lardner's Cabinet Cyclopædia*, by Messrs. Longman; the *Library of Entertaining Knowledge*, by Mr. Charles Knight; the *Library of Useful Knowledge;* Valpy's *Family Classical Library;* and Valpy's *Illustrated Shakspere.* In 1832, the *Edinburgh Cabinet Library*, came forth. Many of these our readers may find, perhaps, in isolated volumes or in complete series on their shelves. In 1844, Mr. Chas. Knight published, at one shilling a volume, Lord Brougham's *Statesmen;* also Mrs. Jameson's *History of Painting.* In 1844, Mr. Murray's *Home and Colonial Library*, was published at 4s. 6d. a volume. It was in the year 1846, that Mr. Bohn gave a new impetus to the publication of Literature for the people, by commencing *Bohn's Libraries.* These volumes appear at the rate of five or six every month, and up to the present date over three hundred and fifty have been issued. The price of these books varies from 3s. 6d. to 5s; they are either valuable reprints of standard works, or translations of ancient and modern authors. Many of Mr. Bohn's modern translations are of peculiar interest, and introduce the English reader to foreign literature of a high order; we have from time to time noticed at length several of these translations, among which our readers will remember the preliminary remarks of Dr. Richard Lepsius, on the result of his journey to Egypt, Ethiopia, and the Peninsula of Sinai,* which appeared at the close of the last volume of the Canadian Journal. Bechstein's Cage Birds is another illustration of instructive foreign literature, for which we are indebted to Mr. Bohn.

It has been said by an able Reviewer in the London *Times*, that "Mr. Bohn's books constitute in themselves a Library with which exclusively any man might be content to endow his son." All who are desirous of dispelling the gloom of ignorance, and while encouraging a taste for literature are anxious that the means for enjoying it should not be wanting, will be glad to know that the great project in which Mr. Bohn is engaged is no longer doubtful in its pecuniary aspect, but promises a speedy and substantial reward.

Canadian Isinglass.

At a meeting of the Society of Arts in December last, Professor Owen again called attention to the supplies of Isinglass which might be expected from Canada, in consequence of the wide distribution of the Sturgeon in the lakes and rivers of this country. There can be no doubt that a profitable branch of industry might be encouraged among the fishermen of the great Lakes. In Lake Huron particularly, the sturgeon is a very abundant fish, and at certain seasons of the year, could be caught in vast numbers. The subject well deserves attention at a time when the Russian commodity is neither supposed to be accessible, or in favour.

Professor Owen "was much struck when fulfilling the duties of Chairman of the Jury on Raw Materials from the Animal Kingdom at the Great Exhibition in 1851, to find that no specimens of Isinglass were exhibited in the Canadian department.—The finest and best specimens of that commodity were exhibited in the Russian department. Isinglass of an inferior description was seen in the Indian department, and amongst the produce of South America and the West Indies. The property of Isinglass which made it most valuable for the refinement of fermented vinous liquors, was dependent upon the peculiar organization of the fibre of the air-bladder, and was not connected with its chemical nature. The air bladder of the sturgeon in particular contained that pure gelatinous material in the greatest quantity, and it was that peculiar characteristic and complex fibre which gave the material the power of catching the feculent matters, and performing all the offices required in the management of fermented vinous liquors. There were unquestionably other fishes which afforded that form of gelatine. Many such were to be found in the Ganges and the Indus, and in the fresh waters of the immense rivers of North America, but in none that he was acquainted with was that peculiar form of Isinglass so fully developed as in the sturgeon species. Looking at the geographical relations with the organic products, he should have expected to find the sturgeon in the North American rivers, and on inquiring of the chief of the Canadian department, he found that such was the fact, and that they were brought by the steamers to Quebec for food, but that the air-bladders were all thrown away. There was a source of wealth which he thought they ought to welcome. He believed the Canadian merchants were capable of affording very large supplies of Isinglass, and he had taken pains to arouse them upon the subject, and he had put the representatives of that department in communication with some of the largest Isinglass merchants in London, and he hoped by this time attention had been awakened to the matter; for he was sure that when a cargo of Isinglass from the air-bladder of the sturgeon arrived from our colonies in North America, it would meet with a pecuniary reward, which would be the best stimulus they could have."

* (See Canadian Journal, Vol. II.)

Remarkable Low Temperature at Isle Jesus, on the 22nd and 23rd December, 1854.

(*Communicated by Dr. Smallwood.*)

On Thursday, the 21st December, 1854, at noon, the thermometer stood at 20°·2 Fahrenheit, with a S.S.W. wind, accompanied with slight snow. The atmosphere during the morning indicated a high electric state. A little before 2, p.m., the wind veered to the N.E. by N., the temperature suddenly fell, and the thermometer stood, at 10, p.m., at 14°·2 (below zero). On Friday morning, the 22d, at 6, a.m., the thermometer stood at 31°·0 (below zero).

At 8,	a.m.,	at	31°·6	(below zero).
9.	...	...	27°·0	do.
10,	...	...	19°·1	do.
11,	...	...	17°·8	do.
12,	noon,	...	16°·6	do.
1,	p.m.,	...	12°·1	do.
2,	...	...	11°·8	do.
3,	...	...	8°·1	do.
7,	...	...	23°·4	do.
8,	...	...	26°·9	do.
10,	...	...	28°·2	do.
Midnight		...	34°·8	do.
23d, at 6,	a.m.,	...	36°·2	do.
7,	...	...	36°·0	do.
8,	...	...	34°·3	do.
10,	...	...	24°·1	do.
12,	noon,	...	13°·4	do.
2,	p.m.,	...	12°·6	do.
4,	...	...	9°·1	do.
6,	...	...	12°·6	do.
10,	...	...	9°·1	do.

There was no display of Aurora Borealis on the night of the 21st, and but a faint Auroral light at the horizon on the night of the 22d. The zodiacal light was very bright, and well-defined, on the morning of the 22d.

Republication of the 1st Volume of The Canadian Journal.

The encouragement which the Council of the Canadian Institute have received from the Library Committee of both Houses of Parliament, as well as from numerous private individuals, in the publication of the Canadian Journal, and to which attention was drawn in the annual report, also in the circular addressed to the Secretaries of Mechanics' Institutes, &c., induces the Council to announce their intention of republishing a limited edition of the 1st Volume of the Canadian Journal, as soon as the number of subscribers whose names have been duly transmitted to the Assistant Secretary of the Institute shall furnish a guarantee that the sale will cover the expenses of publication. It is proposed to reprint a fac-simile of the 1st volume, sewed, with paper cover, for fifteen shillings. Members of the Institute, or subcribers desirous of obtaining a copy of the 1st volume, should intimate their wish to the Assistant Secretary, without delay.

Meteorological Results at Hamilton during 1854.

Mean Results of Meteorological Observations at Hamilton, C. W., for the Year 1854.

Communicated to the Canadian Institute by Dr. Craigie.

1854.	Thermometer.					Barometer.					
MONTHS.	9 A. M.	9 P. M.	Mean of both.	Highest.	Lowest.	Mean.	High-est.	Lowest	Rainy Days.	Sleet Showers	Dry Days.
January	26·13°	27·22°	26·675	53	3	29·671	30·20	29·00	5	10	16
February	24·57	27·392	25·981	49	1	734	30·20	15	6	4	18
March	35·32	35·612	35·466	61	14	608	30·10	02	5	6	20
April	44·66	43·93	44·3	82	24	7225	30·18	25	4	5	21
May	56·84	55·00	55·92	85	32	647	30·00	30	4	6	21
June	69·00	67·50	68·25	97	52	65	29·96	37	1	6	23
July	75·58	75·00	75·29	101	55	765	94	50	2	6	23
August	71·35	70·03	70·69	98	53	74	92	48	2	6	23
September	63·57	64·33	63·95	100	40	777	30·15	44	4	4	22
October	53·032	53·00	53·016	83	32	743	30·16	28·86	3	7	21
November	40·50	40·80	40·65	60	21	49	30·22	77	3	9	18
December	27·967	27·967	27·967	56	2	62	30·16	98	4	10	17
Means	49·043	48 982	49.013			29·6896			43	79	243

Years.	Mean Temperature.
1846	50·215
1847	48·163
1848	49·295
1849	48·105
1850	48·732
1851	48·756
1852	48·248
1853	49·474
1854	49·013
Mean	48·67

NOTICES OF BOOKS.

"*Lives of the Queens of England before the Norman Conquest*," by Mrs. Matthew Hall. Philadelphia: Blanchard and Lea, 1854; 8vo., pp. 469.

The records of the period which the authoress of the work before us enjoyed an opportunity of consulting, are so scanty, that it may well be a matter of surprise that so much could have been written on a subject respecting which so little is known. Mrs. Hall, however, has made full use of traditional tales and romantic annals, and has woven with her history many striking incidents of the age and remarkable features of character, which we may receive as true or imaginary according to fancy. We have no doubt, however, that this book will be a general favorite, as it is pleasingly written. The subject is attractive, and notwithstanding the mystery with which much of it is enveloped, will suit many tastes, although it may not inform many minds.

"*The American Almanac and Repository of Useful Knowledge, for the year* 1855." Phillips, Sampson & Co.: Boston.

This is the twenty-sixth volume of the "American Almanac," an admirable and concise exposition of the affairs of the General and State Governments of the United States; of their Public Institutions, Indian Affairs, Army and Navy. Commerce and Navigation, Revenue and Expenditure, Post-Office, Mint, Public Lands, &c., &c.

The Astronomical Department is highly valuable, having been prepared by G. P. Bond, of the Cambridge Observatory. The European portion of the work gives the several States of Europe, their form of Government, the name, title and date of accession of the reigning sovereigns, the area and population of the several countries, &c., &c.

"The American Almanac" is a work which commends itself to Canadians as well as to the people of the United States. The able critique which appeared some years ago in a Boston Journal has had a beneficial effect, and the name of Mr. Bond will be a security that errors similar to those then noticed by the reviewer will not be found in the present issue.

On the Solidification of Bodies under Great Pressure.*

Mr. Fairbairn read a Paper which contained the results of a portion of the experiments conducted by himself, Mr. Hopkins and Mr. Joule, at the request of the Association, and by means of funds supplied for that purpose by the Royal Society. At the last meetiag at Hull, Mr. Hopkins alluded to these experiments, and then explained the nature of apparatus invented by Mr. Fairbairn for submitting the substances to be operated on to the euormous pressure of 90,000 lbs. on the square inch. In these inquiries the objects kept in view were, to ascertain tho exact laws which govern the cohesive strength of bodies in their present physical condition, and how far a knowledge of those laws may conduce to the reduction of the metals and their subsequent solidification under circumstances whereby increased strength and density may be obtained. The experiments commenced with spermaceti, bars of which were cast and left to solidify at the same temperature, but under different pressures. When pressure was applied to these bars, the one that sustained a pressure of 40,793 lb. carried 7·52 lb per square inch more weight than one submitted to a pressure of 6,421 lb., the ratio being in favor of the more strongly compressed bar, in its power of resistance to a tensible strain, as 1 to ·876. It appeared from these experiments that bodies when solidified under pressure have not only their densities greatly increased, but their molecular structure is also materially affected, so as to increase their adhesive power. Still further to elucidate the subject, cubes of exactly one inch were carefully prepared and loaded with weights till they were crushed. The first cube, solidified under a pressure of 6,421 lb., was crushed with 213 lb. Tin was then operated on; a quantity of pure tin being melted and then allowed to solidify; first at the pressure of the atmosphere and afterwards at a pressure of 908 lb. on the square inch. The same quantity taken from the same ingot was subsequently submitted to a pressure of 5,698 lb. on the square inch. The bars after being solidified and allowed to cool for upwards of fourteen hours, were subjected to the usual tests of tensile strains. From these experiments there was derived, as nearly as possible, the same law or measure of strength in regard to the effects of pressure as obtained from the experiments on spermaceti; for with the same pressures of 908 lb. and 5,698 lb. upon the square inch, the breaking weights were 4,053 lb. and 5,737 lb. or in

* Meeting of the British Association in 1854.—*Athenæum.*

the ratio of 1 to ·706, being an increase of nearly one-third on the crystalized metal when solidified under about six times the pressure. From these facts Mr. Fairbairn observed, it is evident that the power of bodies to resist strain is greatly increased when solidified under pressure; and he said he considered it highly probable that the time is not far distant when the resisting powers of metals, as well as their densities, may be increased to such an extent as to ensure not only greater security, but greater economy by solidification under pressure. He said he was borne out in these views by the fact, that the specific gravities of the bodies experimented on were increased in a given ratio to the pressure. Spermaceti solidified under a pressure of 908 lb. on the square inch had a specific gravity of 0·94859; whilst that solidified under a pressure of 5,698 lb. had its specific gravity increased to 0,95495. The specific gravity of tin solidified under a pressure of 908 lb. was 7·3063; and that solidified under a pressure of 5,698 lb. was 7·3154, which gave ·0091 as the increased density from pressure. There are further experiments in progress to determine the law that governs this increase of specific gravity, and to determine the conducting powers of bodies solidified under severe pressure. Experiments have also been made on such substances as clay, charcoal and different kinds of timber. From the experiments on powdered dry clay, it appeared that a bar of that substauce $3\frac{1}{2}$ inches long and $1\frac{1}{4}$ inch diameter, after being hammered into the cylinder, so as to become slightly consolidated, was reduced in bulk with a pressure of 9,940 lb. on the square inch to 2·958; with a pressure of 54,580 lb. to 2·3; with 76,084 lb. to 2·288; and with a pressure of 97,588 lb. to 2·195 inches.

A New Arithmometer, or Calculating Machine.*

BY M. T. DE COLMAR, PRESENTED BY THE ABBÉ MOIGNO.

As the Abbé spoke English with difficulty, he requested Professor Wilson to explain the machine to the Section. The machine, which was very beautifully executed, consisted of an oblong box, about thirty inches long by six inches wide. On the face, the machine was furnished with a handle to turn round a number of small holes, at which the digits of the common arithmetic scale, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, made their appearance as the machine worked, and which finally gave the answer. In this machine they were eight in number, but they might be extended to any number. To each of these was an index to be set to the required digit, engraved on a small attached vertical scale, and a small ivory ball to be moved along its scale according to certain simple rules, as the operation to be conducted by the machine varied from addition to multiplication, &c. Upon drawing out the sliding bottom of the machine, the machinery was exposed to view. This, though simple, could not be intelligibly explained without the machine or diagrams. The chief part of it consisted of eight cylinders so arranged that, as they turned, the digits, enamelled on a circle at their upper parts, came in succession to the holes in the face; while by a number of indentations arranged spirally round them the digit to which the index was set would be stopped at the hole on the face at the digit corresponding to that at which the index was set; while by a set of pinions a connexion was given to them something similar to that in the common bank-note machine, so that addition could be performed and the result appear on the face:—thus by turning the handle once, the number itself appeared; by turning a twice every digit in it was doubled, and the result appeared above it twice the number originally set, and so on with any multiple of the number so set; then by moving the ivory ball any simple multiple of 10 times, 100 times, 1,000 times, and so the number set could be obtained and added to those previously obtained, and thus the operation of multiplication performed of any number by any number to the extent the machine could give, in this case up to 99,999,999 or nearly 100,000,000. The Professor then exemplified this, by setting a large number and multiplying it by a number which consisted of three digits. He then explained how the other operations were to be performed, showing that the machine could add, subtract, multiply, divide, raise to an integer power, or extract the square or cube root with precision and rapidity. The price of the machine exhibited was £50.

On the Cause of the Phenomena exhibited by the Geysers of Iceland.*

BY DR. STEPHENSON MACADAM.

These Geysers were singled out, because our knowledge of them is such as to entitle us to speculate on the force at work; but, at the same time, it is highly probable that a theory which will explain the Iceland Geysers will also account for those found in California. These Geysers are essentially intermittent hot springs from which, at intervals, there issue successive jets of water, and thereafter immense volumes of steam. When these have been ejected, the Geysers remain quiescent for a longer or shorter time, In endeavouring to account for the phenomena in question, the author assumes that there exists in connexion with each Geyser a subterranean chamber, the floor of which is of a roundish form, and at a temperature of not less than 340° Fahr. At or near the roof there are fissures communicating with springs or reservoirs of water, by which the latter may be allowed to flow into the caverns,—the tube which passes from the cavity to the surface of the earth taking its rise from the side of the chamber and very near the lowest part. Without entering into details, the author assumed this tube (as other writers on the Geysers have done) to be somewhat like an inverted syphon; the shorter limb of which communicates with the chamber, whilst the longer limb, pursuing a tortuous course upwards, forms the exit or omission tube of the Geyser. Water finds access by the fissures into the cavity, where, from the high temperature of the matter it falls upon, it is immediately compelled to assume the spheroidal condition; its temperature while in that state being 205·7° Fahr. The water gradually accumulates, till at last so much has entered the cavity that the heated floor can no longer keep the liquid in the spheroidal state, the water in consequence touches the mineral surface; its temperature is almost instantly raised to 212° Fahr.; and large volumes of steam are generated. This steam, in its passage to the mouth of the Geyser, encounters a body of water which it raises to the boiling point, and thereafter when no more steam can be condensed it forces the heated water from the conduit. The propelling agent having thus cleared a path for itself, the steam escapes in large volumes, with a rushing sound more or less violent. The author, by means of diagrams, illustrated the various forms which the Geyser might be suppposed to present in its internal mechanism. He considered it quite possible that the details given might require to be modified. What he wished to bring prominently forward was, that the spheroidicity of water afforded a means of accounting for the intermittence of the hot springs.

On the Silurian Anthracite of Cavan.*

BY DR. WHITTY.

The author described this deposit as a bed of soft anthracite or culm, about 4 feet thick, occurring in dark grey clay-slate, dipping 80° south-east, with an average strike of 37° west of north. The slaty rock occurs alternately with beds of shale and conglomerate, much altered by metamorphic action. The bed of anthracite varied its direction, but seldom more than a few degrees; it appeared to have suffered much by compression and dislocation, diminishing in a short space to a few inches in thickness, or giving off spurs into the slate rock; portions of the slate were also included in the culm. Its composition was carbon, 77·64; water, 4·35; ash, 18·1. For burning it required mixture with wood or turf. It might be worked like the cornish mines, being nearly vertical, and the water brought out by an adit, without pumping. The value of culm in Cavan was 8 to 10 shillings per ton; of coal, 24 shillings per ton; the culm would be of value for lime-burning.—Dr. Griffiths stated that he had not met with anthracite elsewhere in the grauwacke of Ireland; if this bed could be traced at the surface for a long distance it might be worked like a mineral vein.—Prof. Harkness said, that the attempt to work Silurian anthracite in Scotland had been unsuccessful.

COLONIAL POSTAGE.—There are now thirty-three British colonies, to and from which the letter postage has been reduced to 6*d*. In fourteen of these colonies the postal arrangements are under the control of the local colonial authorities, viz., Ceylon, Trinidad, Barbadoes, Bermuda, Canada, Nova Scotia, Newfoundland, Prince Edward's Island, St. Helena, the Gold Coast, New Brunswick, New South Wales, South Australia, and Victoria; in the remaining nineteen colonies the posts are controlled by the British Postmaster-General, viz., Hong-Kong, Antigua, Gibraltar, Granada, Malta, Berbice, Honduras, Demerara, Bahamas, Cariaco, Jamacia, Tobago, St. Vincent, Montserrat, St. Lucia, Nevis, St. Kitt's, Tortola and Dominica. The whole of the 6*d*. private-ship letter rate belongs to the British post-office for letters to or from the latter-mentioned colonies; and on letters to and from the other colonies the 6*d*. private-ship letter rate is divided equally between the local, colonial and British Governments.

* Meeting of the British Association in 1854.—*Athenæum*.

* Meeting of the British Association in 1854.—*Athenæum*.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—December, 1854.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
1	29·611	29·393	29·458	29·498	24°·1	34°·0	28°·6	28°·7	— 2°·1	0·115	0·155	0·146	0·129	·86	·78	·84	·79	W S W	W S W	W N W	11·81	...	0·2
2	·680	·710	·578	·656	11·2	26·2	23·3	20·9	— 9·6	·052	·083	·094	·079	67	56	74	66	N b W	N b E	N E	6·84	...	3·0
3	·195	·148	—	—	25·2	24·9	—	—	—	·123	·123	—	—	88	89	—	—	E b S	N E	—	17·58	...	3·0
4	·274	·202	·230	·241	15·4	19·1	13·4	15·3	— 14·5	·069	·066	·063	·064	75	62	75	70	N N W	NWbN	N N W	23·21	...	3·5
5	·209	·250	·218	·226	12·0	19·0	22·3	17·9	— 11·5	·065	·079	·092	·080	80	74	75	77	W b N	W N W	W S W	16·09	...	...
6	·016	28.918	28·934	28·954	20·5	26·2	26·9	24·8	— 4·3	·098	·128	·131	·120	86	87	88	87	S W b W	W S W	W S W	13·33	...	2·0
7	·153	29·312	29·572	29·377	15·8	14·3	5·4	11·2	— 17·4	·064	·060	·042	·052	68	68	69	66	N N W	N N W	N N W	15·41	...	0·2
8	·780	·899	30·014	·918	- 1·1	17·9	6·1	8 6	— 19·8	·036	·073	·053	·059	77	71	85	81	N	NWbW	Calm	4·43	...	...
9	30·021	·912	29·787	·887	17·2	31·5	29·1	26·6	— 1·6	·086	·055	·143	·133	85	88	89	89	Calm	S	Calm	4·17	Inap.	...
10	29·650	·721	—	—	33·0	37·7	—	—	—	·142	·143	—	—	75	64	—	—	Calm	W	—	7·15	...	...
11	·720	·751	·805	·760	29·1	28·4	20·8	24·7	— 2·9	·143	·121	·089	·111	89	76	77	79	W N W	NWbN	NWbW	9·92	...	0·1
12	·690	·773	·654	·708	17·6	27·1	24·8	23·2	— 4·1	·080	·111	·102	·098	79	74	75	76	W N W	N N W	S W	10·33	...	0·1
13	·369	·328	·487	·402	34·5	40·6	37·3	37·5	+ 10·4	·165	·193	·193	·181	82	77	87	81	SWbW	W S W	W b S	7·78	...	...
14	·551	·499	·420	·484	30·6	40·9	36·3	35·3	+ 8·4	·147	·136	·183	·163	86	54	86	80	Calm	W S W	S S W	4·68	...	..
15	·352	·302	·315	·323	37·3	41·8	37·0	38·3	+ 11·5	·204	·234	·198	·208	92	89	91	91	S W b S	Calm	Calm	5·40	·030	...
16	·391	·532	·611	·529	28·7	27·6	18 7	24·9	— 1·7	·120	·089	·084	·101	75	58	80	74	N N W	N b W	N b E	10·82	...	0·4
17	·655	·590	—	—	11·1	12·6	—	—	—	·070	·061	—	—	91	75	—	—	NEbN	N E	—	8·02	...	2·5
18	·633	·670	·770	·694	6·5	13·8	0·0	6·5	— 19·7	·051	·058	·038	·050	79	67	81	79	Calm	NWbW	Calm	3·52	...	...
19	·812	·770	·740	·779	- 2·7	10·1	- 5·9	2·0	— 24·1	·043	·057	·033	·046	98	77	92	88	N N W	Calm	NWbN	4·06	...	...
20	·615	·489	·372	·481	14·2	24·9	23·3	20·8	— 5·1	·076	·092	·106	·092	86	67	81	79	Calm	SW bW	SWbW	8·57	...	0·6
21	·364	·559	·788	·591	17·6	22·4	4·9	14·6	— 11·2	·087	·092	·048	·073	85	74	81	79	W b N	N b W	N	11·94	...	...
22	·964	30·070	30·179	30·084	- 2·1	4·5	6·7	3·3	— 22·4	·036	·043	·057	·046	84	75	89	81	N b E	N N E	N N E	6·46	...	Inap.
23	30·191	30·109	29·923	30·054	18·3	17·0	28·0	21·8	— 3·7	·091	·065	·140	·102	88	65	90	81	E S E	N E	Calm	7·06	·030	1·6
24	29·732	29·681	—	—	34·5	37·7	—	—	—	·186	·189	—	—	94	84	—	—	S W bS	SWbW	—	5·93	...	...
25	·717	·630	—	—	36·3	38·8	—	—	—	·197	·191	—	—	93	81	—	—	SWbW	SW b S	—	3·36	...	Inap.
26	·700	·628	·468	29·594	38·8	36·3	36·6	37·2	+ 11·9	·218	·190	·202	·204	93	89	94	92	Calm	E N E	E	5·78	·135	...
27	·469	·606	·675	·588	35·5	39·6	37·0	36·8	+ 11·5	·198	·191	·198	·190	95	79	91	88	Calm	N b E	Calm	2·67	·065	...
28	·448	·187	·334	·323	36·3	39·1	30·0	34·5	+ 9·3	·197	·221	·136	·179	93	93	81	87	E S E	E	NWbW	13·96	·330	Inap.
29	·630	·751	·918	·780	17·0	16·5	7·2	12·5	— 12·7	·082	·057	·047	·061	83	59	72	74	NWbW	N N W	N b W	13·13	...	Inpa.
30	·870	·676	·740	·752	3·6	25·6	26·9	19·2	— 6·0	·043	·119	·133	·098	76	85	89	82	N N W	S S W	Calm	0·92	...	...
31	·844	·849	—	—	27·7	31·6	—	—	—	·123	·117	—	—	80	66	—	—	Calm	E N E	—	4·10	...	...
M	29·581	29·572	29·599	29.587	19·0	25·8	21·0	21·9	— 5·2	0·101	0·115	0·110	0·109	83	74	83	80	9·39	10·78	7·07	8·66	0·590	17·2

Highest Barometer...... 30·245, at 10 a. m. on 23rd } Monthly range:
Lowest Barometer....... 28·917, at 4 p.m. on 6th } 1·328 inches.
Highest registered temp'ture +44°·8, at p.m. on 15th } Monthly range:
Lowest registered temperature —7°·0, at p.m. on 19th } 51°·8.
Mean Maximum Thermometer.................. 29°·46 } Mean daily range:
Mean Minimum Thermometer.................. 14°·38 } 15°·08.
Greatest daily range.........31°·2, from p.m. of 21st to a.m. of 22nd.
Warmest day....... 15th. Mean temperature...... 38°·28 } Difference,
Coldest day......... 19th. Mean temperature...... 2°·02 } 36°·26.
Greatest intensity of Solar Radiation, +52°·0 on p.m. of 14th } Range,
Lowest point of Terrestrial Radiation, —11°·8 on a. m. of 19th } 63°·8.
Aurora observed on 1 night: viz. 29th.
Possible to see Aurora on 7 nights.
Impossible to see Aurora on 24 nights.
Raining on 5 days. Raining 19·0 hours; depth, 0·590 inches.
Snowing on 12 days. Snowing 63·0 hours: depth 17·2 inches.
Toronto Bay was frozen over on the 2nd December, and it continued permanently frozen during the month. Skaters and Pedestrians crossed on the ice from the St. Lawrence Market to the Peninsula Hotel on the 8th.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
3101·02	3156·48	995·16	873·50

Mean direction of the Wind, W 43° N.
Mean velocity of the Wind, 8·66 miles per hour.
Maximum velocity, 38·2 miles per hour, from 10 to 11 a. m. on 4th.
Most windy day, the 4th; mean velocity, 23·21 miles per hour.
Least windy day, the 30th; mean velocity, 0·92 " "

This month has been marked by an unusually early setting in of winter, the thermometer having fallen below zero on the 7th, and the Bay frozen over on the morning of the 2nd. The mean temperature of the month has been 4°·3 below the mean of the last fifteen Decembers, and is the lowest of all but those of 1845, 1850 and 1851. The 19th was the coldest day of the year but one,—January 28th the mean of which was 1°·58.

The depth of rain fallen is nearly an inch below the average, and that of snow 4·2 inches above. The month is also remarkable as having been the most windy month of the whole series of 8 years—the mean velocity being 2·26 miles per hour above the average December velocity; on the 4th the mean of the whole day was 23·21 miles per hour, which much exceeds anything previously recorded.

The change of mean temperature from day to day has been excessive in several instances—thus from the 8th to 9th it rose 18°·, from 19th to 20th it rose 18°·8, and from 22nd to 23rd it rose 18°·5, and from the 28th to 29th it fell 22°.0. Between 10 p.m. on the 19th and 2 p.m. on the 20th there was a rise of temperature of 30°·8.

Comparative Table for December.

Year.	Temperature. Mean.	Dif. from Av'ge.	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind. Mean Velocity.	
1840	24°·3	—1°·9	41°·0	— 4°.4	45°·4	3	Inap.	18	...	...	
1841	28·7	+2·5	45·5	+ 2·4	43·1	7	6·600	5	...	1·33	lb.
1842	24·7	—1·5	40·3	+ 3·8	36·5	3	0·880	17	...	0·61	lb.
1843	30·0	+3·8	41·1	+ 2·7	38·4	6	1·040	8	8·1	0·53	lb.
1844	28·2	+2·0	48·9	— 0·8	49·7	6	Impf	6	4·2	0·40	lb.
1845	21·1	—5·1	37·6	— 2·7	40·3	2	Inap.	12	4·7	0·70	lb.
1846	27·5	+1·3	49·2	+ 3·7	45·5	5	1·215	9	6·0	0·57	lb.
1847	30·1	+3·9	50·0	+ 6·6	43·4	7	1·185	8	6·8	4·55	Miles.
1848	29·1	+2·9	49·1	+ 0·6	48·5	7	2·750	7	16·5	5·44	Miles.
1849	26·5	+0·3	41·3	— 5 2	46·5	5	0·840	12	9·6	6·23	Miles.
1850	21·7	—4·5	48·3	— 9·7	58·0	2	0·190	18	29·5	7·40	Miles.
1851	21·5	—4·7	43·8	—10·5	54·3	6	1·075	15	10·7	7·37	Miles.
1852	31·9	+5·7	51·0	+13·9	37·1	7	3·995	10	20·1	6·54	Miles.
1853	25·3	—0·9	42·2	— 5·2	47·4	4	0·625	13	22·3	4·98	Miles.
1854	21·9	—4·3	41·8	— 5·9	47·7	5	0·590	12	17·2	8·66	Miles.
										0·69	lbs.
M'n.	26·17		44·74	—0·71	45·45	5·0	1·499	11·3	13·0	6·40	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——December, 1854.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10 P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29·858	29·791	29·711	10·6	13·1	12·1	·082	·083	·090	.88	·82	·94	W N W	W N W	W N W	2·03	7·00	0·64	...	...	Str. 10.	Str. 9.	Clear.
2	·819	·914	·996	7·2	10·9	10·7	079	077	072	88	83	78	W	W	W	2·55	4·02	6·37	...	...	Clear.	Clear.	Do.
3	·916	·812	·741	8·9	16·0	17·0	080	092	097	89	85	85	N E b E	N E	N E	3·20	10·38	12·00	...	...	Cir. Str. 10.	Cir. Str. 10.	Cum. Str. 10.
4	·273	·249	·060	16·5	20·1	15·0	096	114	102	83	87	95	N E b E	N E b E	N b W	40 17	19·56	7·04	...	4·80	Snow.	Snow.	Do. 8.
5	·066	·100	·214	4·0	11·0	10·6	038	082	077	61	88	83	W b N	W N W	W N W	11·75	11·70	9·02	...	0·10	Cir.CumStr. 4	Do.	Cir. Cum. 4.
6	·239	·221	·252	12·2	23·2	22·0	090	136	151	94	96	96	W S W	S S W	S W	5·75	1·40	2·88	...	Inap.	Cir. Str. 4.	Sl'gt snow.	Str. 10.
7	·287	·330	·447	25·0	31·5	16·0	138	191	098	37	95	88	S b W	S b W	W b N	1·62	Calm	2·50	...	3·16	Cum. Str. 10.	Snow.	Snow.
8	·699	·840	30·068	7·1	10·5	1·8	078	069	048	80	79	95	N W b W	N W b W	W N W	11·25	12·28	10·32	...	1·00	Sl'tSnow.	Clear.	Clear Au.Bor.
9	30·195	30·189	30·112	– 3·1	8·0	12·1	033	058	070	83	80	73	W	W	E N E	3·26	Calm	0·31	...	...	Clear.	Str. 2.	Str. 10.
10	29·940	29·911	29·894	16·4	32·1	34·6	093	167	186	82	84	87	E N E	E N E	W b S	0·43	0·67	2·19	...	1·00	Str. 10.	Sl'gt snow.	Do. 10.
11	·899	·831	·895	32·0	30·6	16·0	196	197	098	96	95	88	W	W b N	N W	0·16	3·74	7·16	...	...	Do. 10.	Cum. Str. 4.	Do. 10.
12	·965	·992	·999	– 2·0	9·9	0·5	041	068	047	96	93	95	N W	N W	N W	11·25	0·30	Inap.	...	...	Clear.	Clear.	Clear.
13	·601	·650	·650	17·2	35·0	35·0	106	203	203	90	91	91	W b S	W b S	W b S	5·46	2·37	4·00	...	0·81	Snow.	Cir. Str. 4.	Cir. Str. 8.
14	·882	·717	·799	14·0	32·1	14·1	091	182	097	87	91	93	E b N	E b N	E b N	5·31	Calm	Calm	...	...	Cir. Str. 4.	Do. 8.	Str. 8.
15	·682	·500	·505	17·5	33·1	25·6	106	189	147	90	90	92	E b N	E b N	E b N	Inap.	Calm	Calm	...	...	Do. 8.	Clear.	Clear.
16	·515	·642	·846	27·4	33·2	7·9	167	197	063	99	95	93	E b N	E b N	E b N	Calm	Calm	4·17	...	...	Cum. 4.	Cir. Str. 4.	Do.
17	30·081	30·074	·956	– 9·5	– 2·4	– 4·0	029	036	038	94	84	95	E b N	E b N	E b N	2·25	3·43	6·15	...	...	Clear.	Str. 10.	Do.
18	29·814	29·849	·910	– 1·0	5·5	– 5·3	043	058	036	95	91	94	N E b E	N b E	N W b W	15·79	1·34	1·99	...	0·70	Snow.	Cir. 2.	Do. ft. A. L't.
19	·940	·990	·992	–20·3	– 2·1	–12·7	017	036	025	89	90	90	N W b W	N W b W	W N W	Inap.	Calm	Calm	...	...	Clear.	Clear.	Clear.
20	·976	·810	·714	–23·6	5·8	1·0	010	051	043	57	79	85	S W	S	N b E	Calm	Calm	Calm	...	...	Do.	Do.	Str. 10.
21	·612	·662	30·110	12·0	16·1	–14·2	076	084	021	90	84	84	S S W	N E b N	N E b E	0·55	0·87	8·46	...	2·90	Snow.	Snow.	Clear.
22	30·200	30·386	30·482	–31·0	–11·8	–28·2	008	017	010	66	57	84	N E b E	E N E	E N E	3·31	Calm	Calm	...	...	Clear.	Clear.	Do. ft. A. L't.
23	·589	30·594	30·400	–36·2	–12·6	– 9·1	000	008	029	06	30	90	N E b E	N E b E	N E b E	Calm	Calm	2·21	...	...	Do.	Do.	Do.
24	·066	29·910	29·800	5·0	31·0	21·0	053	171	126	85	89	93	N E b E	N E b E	N E b E	6·00	Calm	1·55	...	4·20	Snow.	Snow.	Sleet.
25	29·782	·940	·999	36·0	35·8	32·6	212	210	181	92	91	89	W	W N W	W N W	3·07	0·62	0·14	...	...	Str. 10.	Clear.	Clear.
26	·997	·997	·990	33·7	41·9	23 0	195	263	127	90	89	88	W	N N W	N E	Calm	Calm	Calm	...	...	Clear.	Do.	Cir. 4.*
27	·811	·857	·876	34·1	41·0	36·2	210	253	210	99	92	91	S E b S	S E b S	W b S	1·62	Calm	Calm	0·11	...	Rain.	Str. 10.	Str. 8.
28	·935	642	·451	29·0	35·7	38·0	177	203	230	98	91	94	E b N	E	S	Calm	0·45	1·67	...	...	Fog.	Cir. Str. 10.	Str. 10.
29	·600	·792	·954	22·0	11·0	0·6	120	077	042	84	83	84	W b N	W b N	W b N	11·45	10·62	7·00	...	...	Cir. Str. 4.	Str. 10.	Clear.
30	30·055	30·050	29·942	–12·1	6·3	2·5	021	052	081	77	79	95	W b N	W b N	W b N	1·12	Calm	Calm	...	...	Clear.	Clear.	Cir.Cum.Str.4
31	30·109	30·214	30·252	0·0	20·0	5·0	067	105	053	95	87	89	W b N	W b N	W b N	Calm	Calm	Calm	...	...	Do.	Do.	Cir. Str. 10.

Barometer ....
- Highest, the 23rd day .... 30·594
- Lowest, the 4th day .... 29·060
- Monthly Mean .... 29·540
- " Range .... 1·534

Thermometer.
- Highest, the 26th day .... 41°·9
- Lowest, the 23rd day .... —36°·2
- Monthly Mean .... 7°·35
- " Range .... 78°·1
- Mean Humidity .... ·850

Greatest Intensity of the Sun's Rays .... 116°·9

Rain fell on 1 day, amounting to 0·11 inches. Raining 4 hours, 30 minutes.

Most prevalent Wind, N.E.bE. Least prevalent Wind, E.

now fell on 10 days, amounting to 18·67 inches. Snowing 44 hours 31 minutes.

Most Windy Day, the 4th day; mean miles per hour, 22·25.

Least Windy Day, the 30th day; mean miles per hour, 0.0

Aurora Borealis visible on 3 nights. Might have been seen on 10 nights.

Winter fairly set in 4th day.

The lowest temperature observed here was on the 23rd day, at 6 a.m., and was –36.2.

Zodiacal Light very bright frequently during the month.

The Electrical state of the atmosphere has indicated generally a high tension, and during the great storm on the 4th day indicates a very high tension of Negative Electricity, and continued with little decrease in intensity during the whole of the storm, reaching very frequently to 500°. in terms of Volta's No. 1 Electrometer.

Ozone was present very frequently during the month

* Lunar Halo, diameter 45°·6.

Monthly Meteorological Register, Quebec, Canada East, December, 1854.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	29·563	29·514	29·452	29·510	16·5	14·6	12·6	14·6	0·074	0·078	0·076	0·076	76	78	93	82	N W	N W	N W	8·8	8·8	6·2	...	...	
2	·501	·622	·761	·628	8·9	14·8	9·7	11·1	·059	·056	·070	·062	85	78	77	80	W N W	W	N W	11·3	17·9	7·2	...	...	
3	·792	·760	·684	·745	5·0	16·6	17·6	13·1	·049	·091	·091	·077	83	93	90	89	S	E N E	E N E	3·8	11·3	42·5	...	0 6	3rd. Lunar Halo at 10 p.m.
4	·284	28·931	28·668	28·961	18·4	24·1	26·3	22·9	·099	·126	·138	·121	94	95	96	95	N E	N E	N E	70·0	56·7	8·0	...	4·5	4th. Barometer very un-
5	28.608	28·753	28·860	28·741	16·8	12·7	11·2	13·6	·099	·078	·072	·083	100	93	94	96	W	W	W	11·3	22·7	11·3	...	0·4	steady, varying occasionally
6	29·037	29·102	29·127	29·089	6·8	11·9	21·1	13·3	·059	·077	·096	·077	92	96	81	90	N W	Calm.	Calm.	11·3	0·0	0·0	...	1·5	0·1 inch.
7	·158	·198	·237	·198	21·6	25·5	24·1	23·7	·115	·119	·132	·122	95	85	100	93	Calm.	N	Calm.		2·0	0·0	...	2·0	
8	·253	·431	·765	·483	22·0	15·5	5·4	13·6	·091	·054	·052	·069	75	57	85	72	W	N W	N W	8·0	13·4	5·2	...	...	
9	30·060	30·195	30·105	30·120	– 1·8	7·6	9·7	5·2	·042	·056	·067	·055	96	85	93	91	N W	N N W	Calm.	6·2	7·2	0·0	...	1·2	9th. Lowest point of Ter-
10	29·929	29·737	29·734	29·800	15·0	27·3	29·3	23·9	·087	·124	·151	·121	95	83	93	90	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	1·1	restrial Radiation.—8°.
11	·665	·516	·588	·590	32·2	31·8	16·1	26·7	·162	·163	·080	·135	89	92	84	88	Calm.	S W	W	0·0	2·0	11·3	...	1·9	
12	·713	·751	·806	·757	7·4	9·8	4·6	7·3	·061	·062	·053	·059	92	86	90	89	N W	W	W	5·2	3·8	5·2	...	...	
13	·628	·346	·408	·461	3·4	15·5	24·2	14·4	·053	·089	·127	·090	95	95	95	95	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	3·5	
14	·676	·726	·637	·680	14·5	15·5	17·6	15·9	·074	·082	·092	·083	83	88	91	87	Calm.	E	Calm.	0·0	3·8	0·0	...	...	
15	·522	·489	·452	·488	23·2	33·5	33·4	30·0	·117	·169	·171	·152	91	89	91	90	Calm.	Calm	Calm.	0·0	0·0	0·0	·033	0·6	
16	·314	·344	·676	·445	33·1	34·0	13·5	26·9	·170	·146	·065	·127	90	74	76	80	S W	W b S	W b S	3·8	3·8	3·8	...	...	16th. Auroral light ob-
17	·859	·933	·886	·926	3·2	0·5	0·8	1·5	·038	·046	·	·	71	95			S	E	N E	2·0	11·3	16·0	...	...	served.
18	·753	·635	·634	·674	– 0·6	6·0	2·8	2·7	·042	·059	·046	·049	93	94	84	90	N E	N E	Calm.	19·7	11·5	0·0	...	3·2	
19	·815	·781	·841	·812	– 9·1	– 3·8	– 7·8	– 6·9	·027	·036	·030	·031	87	90	89	89	W	W S W	Calm.	7·2	5·2	0·0	...	...	
20	·817	·687	·550	·685	–14·0	– 2.3	4·0	– 4·0	·023	·036	·049	·036	92	84	85	87	W	W N W	Calm.	2·0	5·2	0·0	...	1·0	
21	·430	·465	·939	·611	8·2	12·0	–12·6	2·5	·060	·055	·018	·043	87	68	59	71	Calm.	N W	N W	0·0	7·2	5·2	...	2·9	
22	30·169	30·298	30·423	30·297	–17·8	–11·0	– 8·6	–12·5	·013	·017	·023	·018	66	57	72	65	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...	22nd and 23rd. A heavy
23	30·553	30·513	30·381	30·482	–16·0	– 4·8	– 2·1	– 7·6	·013	·021	·040	·025	56	53	91	67	Calm.	Calm.	Calm.	0·0	0·0	0 0	...	...	fog over the River St. Law-
24	30·165	29·869	29·637	29·890	6·2	18·2	23·4	15·9	·061	·094	·124	·093	95	91	96	94	Calm.	E	Calm.	0·0	3·8	0·0	0·40	3·8	rence. 23rd. At 10½ a.m.,
25	29·584	·659	·667	·637	26·7	34·2	32·6	31·2	·142	·159	·170	·157	97	79	93	90	Calm.	S W	Calm.	0·0	5·2	0·0	...	...	Barometer 30·621 inches.
26	·755	·872	·917	·848	29·8	32·0	26·1	29·3	·162	·162	·127	·150	93	90	87	90	Calm.	S W	Calm.	0·0	3·8	0·0	...	...	
27	·753	·661	·797	·737	26·9	29·8	31·2	29·3	·135	·162	·174	·157	90	97	100	96	E N E	E N E	Calm.	7·2	2·0	0·0	...	1·5	
28	·832	·658	·387	·626	22·8	30·0	29·6	27·5	·112	·162	·157	·144	88	96	96	93	Calm.	N E	N E	2·0	11·3	13·9	0·50	0·8	
29	·212	·456	·727	·465	32·2	16·4	5·2	17·9	·179	·076	·055	·103	98	78	90	89	Calm.	W S W	W S W	0·0	12·9	11·3	...	...	29th. Halo round Moon
30	·891	·911	·890	·897	– 0·8	2·4	– 0·8	0·3	·041	·037	·042	·040	91	85	93	90	W S W	W S W	W S W	12·4	5·2	8·8	...	...	20° in diameter.
31	·945	·987	30·128	30·020	– 3·8	5·4	4·0	1·8	·038	·056	·057	·050	95	90	100	95	S	E N E	Calm.	3·8	3·8	0·0	...	0·2	31st. Heavy fog at 10p.m.
–	29·653	29·642	29·670	29·655	10·87	15·34	13·04	13·08	0·082	0·090	0·088	0·087	85	87	89	87				6·32	7·74	5·09	·123	30·7	

Maximum Barometer, 10½ a.m. on the 23rd	30·621
Minimum Barometer. 6 a.m. on the 5th.,	28·608
Monthly Range	2·013
Monthly Mean	29·655
Maximum Thermometer on the 16th	36°.6
Minimum Thermometer on the 22nd	–19°·2
Monthly Range	55·8
Mean Maximum Thermometer	19·39
Mean Minimum Thermometer	4·17
Mean Daily Range	15·21
Mean Monthly Temperature	13·08

Greatest Daily Range of Thermometer on 16th	33°·4
Least Daily Range of Thermomter on 17th	3°·8
Warmest Day, 25th. Mean Temperature	31·2
Coldest Day, 21st. Mean Temperature	—12·5
Climatic Difference	43·7

Possible to see Aurora on 10 Nights.
Aurora visible on 4 Nights.
Total quantity of Rain, 0·123 inches.
Total quantity of Snow, 30·7 inches.
Rain fell on 3 days.
Snow fell on 17 days.

The Canadian Journal.

TORONTO, MARCH, 1855.

The Solar Eclipse of May 26th, 1854.

Extract from the Minutes of the Council of the Canadian Institute.

"*Resolved*, That Professors Cherriman and Irving be appointed a Committee to draw up instructions for general distribution relative to the approaching Solar Eclipse."

Supplementary Report of the above Committee.

Read before the Institute, January 13th, 1855.

The Committee, appointed by the Council of the Canadian Institute to draw up suggestions for observers of the Solar Eclipse of May 26, 1854, having received from several stations in Canada accounts of observations made with reference to the instructions published by order of the Institute, have thought it advisable to lay them before the Institute in a connected form, and at the same time, as several of the phenomena mentioned in their former report have escaped observation, it appeared desirable to enter at some length into the grounds on which these phenomena were expected to occur and to examine the probable cause of their not having been observed. Many of the points thus involved are of considerable general interest, and the explanation of them is in some cases not easy and even doubtful; neither is information regarding them very accessible: your Committee, therefore, will claim the indulgence of the Institute while discussing these points with a minuteness, which might be tedious and superfluous were they addressing professed astronomers, but which may not be deemed improper in offering to amateur-observers the received or probable explanations of the points in question.

Notices of observations have been received from the following stations:—

1. Kingston, by Lieut. Col. Baron de Rottenburg and Fred. J. Rowan, Esq., from a position contiguous to Murney's tower. Mr. Rowan used a small telescope, by Troughton & Sims, attached to a transit theodolite; Baron de Rottenburg a telescope by Dolland, three and a quarter feet focal length, with an object glass two and a quarter inches. The mean time was obtained from several double altitudes of the sun taken on the days preceding the eclipse and continued up to the day itself by Mr. Rowan. The watches used were of a description to be depended upon, with a probable error of three or four seconds only. The register of the thermometers was carefully attended to by the Messrs. Williams, of Kingston; one thermometer was placed in sunshine, the other kept in the shade; the one placed in sunshine had its bulb blackened. The day throughout was most serene and cloudless, and highly favourable in all respects.

2. At St. Martin, Isle Jesus, Montreal, by Dr. Chas. Smallwood, who contributes a series of physical observations made at intervals of fifteen minutes. It is to be regretted that the day was unfavourable, and thus diminished the importance which the excellence of the instruments and Dr. Smallwood's well known experience and skill would have given to such a series. He observes, "Clouds (Cum. Strat.) had been somewhat heavy for some hours previous, but a few minutes before four o'clock they cleared away and left the first contact visible, and remained so with light clouds occasionally passing over the sun's disc until after the greatest obscuration. The final contact was obscured by dense (Stratus) clouds which continued until 6h.-45m., when the sun re-appeared under its usual aspect."

3. Toronto, the Observatory, by Sergeant Jas. Walker, Corporal A. Stewart, and Gunner James Lily, R.A. Physical observations were taken every five minutes with the Observatory instruments, under the usual precautions. The small portable Azimuth-transit telescope was used for noting the times of contact, which were given by the Observatory Chronometer (2393), whose error and rate were known. The day was in every respect favourable.

4. Prescott, C.W., by the members of the sub-committee, Sergeant Thos. Menzies, R.A., Mr. Ed. Fitzgerald, B.A., and Mr. William Cooper. The telescopes employed were a two-feet Gregorian reflector, by Watkins & Hill, four inches diameter, and a three and a half feet refractor, by Dunn, with two and three quarter inches aperture. The magnifying power employed in each was forty. The time was given by an excellent portable chronometer by Arnold, whose error and rate for Toronto were known, an approximate allowance of 15*m.* 20*s.* being made for the difference of longitude between Prescott and Toronto. The observations were made on the West Bastion of the Fort which is situated on a gentle rising ground to the east of Prescott. The day was very favourable, the sky being perfectly cloudless, though a boisterous wind interfered with the steadiness of the telescopes.

5. Observations were also attempted at Montreal, by Lieut. A. Noble, R.A., but were prevented by clouds.

The following table gives the times of occurrence of the various phases at the stations named.

	Kingston. Lat. 44°-8' N.? Long. 76°-40' W.?	Toronto. Lat. 43°-39'·4 N. Long. 79°-21' W.	Prescott.* Lat. 44°-42' N.? Long. 75°-31'-58" W?
Local times of.....	Eclipse annular but not central.	Partial. eleven digits obscured	Annular and nearly central.
Commencement of Eclipse	*h. m. s.* 3 57 18	*h. m. s.* 3. 44 42·5	*h. m. s.* (1) 4 03 17 (2) 4 03 19·5 †
Com. of Annularity.........	5 12 38		(1) 5 17 09·2 (2) 5 17 09·0
End of Annularity	5 15 42		(1) 5 21 02·5 (2) Missed.
End of Eclipse...............	6 22 25	6 14 07·7	(1) 6 27 05·5 (2) 6 27 05·8

The astronomical application of these *times* is to furnish, by comparison of numerous other stations, corrections to the tables of the sun and moon, and also to give approximately the differences of longitude of the stations themselves; but to enter into these particulars does not fall within the scope of the present paper.

The following tables embrace the Meteorological Observations forwarded from the different stations:—

* No. (1), Refracting telescope, J. B. C.; No. (2) Reflector, G. C. I.

† This observation is too late, a violent gust of wind at that time shaking the telescopes so as to render distinct vision impossible.

Kingston.

Local Mean Time.			Thermometer in sun with blackened bulb.	Thermometer in shade.
h.	m.	s.		
3	57	18	82°	72°
4	09	15	79	71
4	37	29	77	70
4	48	40	74	69
4	57	00	72	66
5	12	55	67	66
5	15	59	66	65
5	25	00	67	64
5	30	00	69	65
5	35	00	71	65
5	45	00	73	67
6	00	00	75	65
6	15	00	76	66
6	22	42	75	...

St. Martin, Isle Jesus, Montreal: height above level of sea 118 *feet.*

Local Mean Time.	Bar. reduced to 32° Fah.	Temperature of Air.	Tem. of Dew-point.	Tension of Aqu. Vapour.	Humidity.	Direction of Wind.	Velocity in miles per hour.	Cloudiness. Overcast = 10.	Course of Clouds from.	Thermometer in Sun with blackened Bulb.	REMARKS.
h. m.	Inches.	Fah.		Inches							
2.00	29.671	73.0°	60.8°	0.534	.65	N E b E	...	Cum. Str. 4	N E	95.0°	Sun clear of Clouds.
3.00	.678	70.1	58.8	.491	.68	do.	7.27	do. 8	N E	85.0	Sun clouded.
4.00	.705	69.1	57.8	.486	.69	do.	1.75	do. 6	N E	75.3	Do.
4.11	.705	71.0	57.5	.481	.64	do.	1.75	do. 2	N E	95.0	Sun clear. First contact.
4.30	.705	73.5	59.3	.508	.63	do.	1.60	do. 2	N E	104.0	Do.
4.45	.708	72.4	60.0	.523	.67	do.	1.12	do. 4	N E	94.3	Do.
5.00	.718	71.6	58.6	.498	.64	do.	0.55	do. 4	N E	86.1	Do.
5.15	.722	68.0	56.2	.461	.65	E N E	0.50	do. 4	N	75.2	Do.
5.27	.722	66.5	56.4	.464	.72	do.	0.25	do. 4	N	71.3	Greatest Obscuration.
5.30	.728	66.0	58.0	.489	.76	do.	0.12	do. 4	N	72.5	Sun clear.
5.45	.729	65.1	58.6	.499	.80	do.	0.20	do. 4	N	74.2	Sun clouded with dense *Stratus*.
6.00	.733	64.7	55.5	.450	.75	do.	0.45	do. 2	E N E	67.6	[Zenith clear.
6.15	.759	64.0	55.5	.425	.71	do.	0.45	do. 2	E N E	66.0	Do.
6.30	.740	63.6	54.5	.435	.75	do.	0.62	do. 2	E N E	65.6	Do.
6.45	.740	63.6	54.5	.435	.75	do.	0.10	do. 2	E N E	71.0	Sun clear. End of Eclipse.
7.00	.748	64.0	55.5	.450	.75	E b N	1.30	do. 2	E N E	70.7	Do.

Prescott.

Local Mean Time.	Thermometer in Shade. Dry Bulb.	Wet Bulb.	Difference.	Aqu. Vapour. Ten. in inches.	Humidity.	Radiation. Solar.	Terrestrial.
h. m.							
4.08	71.5°	57.5°	14.0°	0.304	.40	81.0°	72.5°
.11	71.0	57.0	14.0	.294	.40	82.5	71.5
.16	71.2	57.2	14.0	.299	.40	82.2	71.5
.21	70.2	57.5	12.7	.321	.45	82.2	69.0
.26	70.0	56.0	14.0	.279	.39	81.0	69.0
.31	69.8	56.5	13.3	.296	.41	79.5	68.5
.36	69 8	56.8	13.0	.301	.43	78.7	66.4
.41	69.6	56.4	13.2	.294	.41	76.0	66.6
.46	69.5	56.0	13.5	.289	.41	76.0	68.0
.51	69.2	55.8	13.4	.283	.41	75.8	68.4
.56	68.2	55.8	12.4	.296	.44	75.6	67.4
5.01	67.0	55.2	11.8	.308	.46	73.4	67.0
.06	67.7	54.8	12.9	.276	.42	71.7	66.6
.11	66.8	54.4	12.4	.275	.43	70.4	65.8
.16	66.2	54.2	12.0	.276	.44	68.8	65.0
.17	66.2	54.2	12.0	.276	.44	68.0	64.6
.22	66.1	54.2	11.9	.277	.44	68.0	64.2
.26	66.2	53.8	12.4	.266	.42	68.4	64.8
.31	65.5	54.0	11.5	.278	.45	68.8	64.5
.36	65.0	53.8	11.2	.278	.46	69.2	64.0
.41	65.0	53.8	11.2	.278	.46	70.0	64.0
.46	65.0	54.0	11.0	.284	.47	70.8	63.8
.51	65.4	54.4	11.0	.289	.47	71.4	64.4
.56	65.6	54.4	11.2	.286	.46	72.2	64.8
6.01	65.2	54.7	10.5	.299	49	73.8	64.4
.06	65.2	54.8	10.4	.305	.50	74.5	64.3
.11	65.8	55.2	10.6	.307	.50	75.2	64.7
.16	65.8	54.8	11.0	.296	.48	76.0	64.4
.21	65.5	55.0	10.5	.304	.50	76.2	64.6
.26	65.5	55.5	10.0	.309	.52	76.8	65.0
.27	65.2	54.8	10.4	.304	.50	75.8	64.4
.31	65.7	55.0	10.7	.316	.50	75.8	64.7

At the beginning of the eclipse, the wind was blowing fresh from W.N.W., and continued so until 4*h*.-45*m*., from which time it gradually decreased till, at the annularity and afterwards, it was almost calm.

The thermometers (dry and wet bulb) were mercurial by Negretti No. 42: they were attached to the N.E. end of the platform in perfect shade, the bulb about three feet above the tread of the banquette, which is gravelled, but shaded by the parapet.

The solar-radiation thermometer was a Kew Standard (No. 63), with its bulb coated with lamp-black: it was suspended in the entrance of a sentry-box facing South, the box being painted a dark leaden colour, and forming a good position.

The thermometer for terrestrial-radiation was also a Kew Standard (No. 64), protected from the sun's direct rays, and also by a concave of tin from the radiation of the ground, but the exposure of this instrument was imperfect, and the results are not to be depended on.

Toronto Observatory. Height above sea level 342 feet.

Local Mean Time.	Ther. in Shade. Dry Bulb.	Wet Bulb.	Difference.	Aqueous Vapour. Ten. in inches.	Humidity.	Radiation. Solar.	Terrestrial.	Barom. reduced to 32°.	Wind. Direction.	Velocity in miles.
h. m.	°	°	°			°	°			
3.30	66.9	61.1	5.8	0.459	.71	86.4	60.4	29.632	SW b S	
.35	67.0	61.1	5.9	.458	.71	86.2	60.4			
.40	66.7	60.7	6.0	.454	.71	86.9	60.0	29.630		
.45	66.9	60.9	6.0	.454	.71	84.0	59.8			
.50	65.8	59.9	5.9	.426	.70	82.7	59.2			
.55	66.1	60.0	6.1	.437	.70	82.8	59.0	29.628		
4.00	66.0	60.0	6.0	.438	.71	82.6	59.2		SW b S	2.9
.05	65.8	59.6	6.2	.428	.70	82.5	59.0			
.10	65.7	59.6	6.1	.429	.70	82.4	58.2	29.628		
.15	65.6	59.5	6.1	.427	.70	80.1	57.9			
.20	65.6	59.5	6.1	.427	.70	77.8	57.8			
.25	65.2	58.5	6.7	.402	.67	77.6	58.0	29.620		
.30	65.4	58.3	6.1	.408	.70	75.0	58.0			
.35	65.0	58.6	6.4	.408	.68	74.4	57.8			
.40	64.9	57.6	7.3	.381	.64	72.6	58.0			
.45	64.9	58.8	6.1	.416	.70	72.4	58.0			
.50	64.8	58.3	6.5	.402	.67	69.4	58.0	29.624		
.55	64.0	58.1	5.9	.405	.70	67.2	57.8			
5.00	64.0	57.9	6.1	.401	.69	65.1	57.2		SW b S	2.7
.05	64.1	57.7	6.4	.393	.68	63.4	56.8			
.10	64.0	57.6	6.4	.391	.68	63.5	55.4			
.15	63.8	57.1	6.7	.379	.66	64.2	54.8	29.626		
.20	64.0	56.8	7.2	.368	.64	65.4	53.8			
.25	62.3	56.9	5.4	.390	.72	67.2	54.3			
.30	62.6	57.1	5.5	.393	.72	69.8	53.2			
.35	62.8	56.8	6.0	.381	.68	71.6	53.2			
.40	63.1	57.0	6.1	.385	.69	72.4	53.0	29.626		
.45	63.0	56.1	6.9	.359	.64	73.2	53.8			
.50	63.1	56.6	6.5	.373	.66	73.6	54.2			
.55	63.1	56.8	6.3	.378	.67	73.8	54.8			
6.00	63.6	57.0	6.6	.378	.66	73.5	55.0			
.05	64.1	57.1	7.0	.376	.65		55.4	29.626	SW b S	1.2
.10	64.3	57.3	7.0	.380	.65		55.2			
.15	64.1	57.1	7.0	.376	.65	76.4	55.2			
.20	64.8	57.5	7.3	.381	.64	78.2	54.8			
.25	65.3	57.6	7.7	.381	.62	76.4	51.6			
.30	65.3	57.5	7.8	.374	.61	75.6	51.0	29.626	SW b S	0.8

The dry and wet bulb thermometers were the Observatory Standards in their usual position.

The thermometer for solar radiation was a mercurial by Watkins & Hill, its bulb covered with a coating of lamp-black dissolved in spirits of wine, and freely exposed to the sun's rays.

The usual thermometer for terrestrial-radiation was employed, its bulb in the focus of a polished planisphere, and protected from the sun's direct rays.

In considering the meteorological effects produced by the abnormal extinction of the sun's heat in an eclipse, it is evident that these effects are always mixed up with the ordinary changes that are produced by the ever-varying conditions of the atmosphere and the other causes that determine the meteorological conditions at a given time and place, and it is only by a comparison of results obtained at numerous stations that these latter can be eliminated. Still, an examination of even the few sets in the preceding tables will furnish several points of interest. Thus, at Montreal, the rise of the barometer is marked and steady; at Toronto, on the contrary, the barometer sank during the early part of the eclipse, and then, after a slight rise, remained perfectly steady during the latter half of the period, showing that the rise at Montreal was not a phenomenon peculiarly connected with the eclipse. Again, at Prescott, the tension of aqueous vapour fell somewhat suddenly about ten minutes before the annularity, reached its lowest point five minutes after the end of the annularity, and then increased during the remaining period; at Toronto, the changes are more irregular, but indicate, on the whole, a descent throughout; while at Montreal the same fact may be noted, though with still greater irregularity.

The following abstract gives the values of this tension for the three places at the times of beginning and end, and greatest obscuration, and also the mean values for the first and latter halves of the duration of the eclipse:—

Tension of Vapour.........	Prescott.	Toronto.	Montreal.
Beginning of Eclipse.......	0·304	0·459	0·481
Middle..........................	·276	·393	·464
End	·304	·376	·435
Mean of First Half.........	·293	·418	·489
Mean of Latter Half.......	·289	·360	·457

In the total eclipse of 1842, it was noticed at Perpignan that a strong dew was deposited after the total obscuration, falling in drops from the leaves, the explanation of which is clearly that the temperature of the earth had been more reduced by radiation than that of the air by the deprivation of the sun's rays, and to such an extent as to reduce the contiguous strata of air below the dew-point temperature, and thus cause them to deposit dew. It is, therefore, a point of interest to examine if, during the eclipse, any increase of humidity can be detected in the atmosphere, which can fairly be traced to such a cause. An examination of the tables shows that none such can be detected, the humidity decreasing at Toronto and increasing at Prescott with about equal steadiness, while at Montreal the changes are less regular, but give an increase in the latter half of the period over the former.

As might be expected, the effect of the deprivation of the sun's heat on the temperature of the air is decisively manifested by the thermometrical observations, of which those at Toronto and Prescott, having been made by standard instruments and with all possible precautions, may claim a certain degree of precision; those at Montreal are less available by reason of the unfavourable nature of the day. As regards the march of the ordinary dry bulb thermometer, two causes are involved, at first conspiring but afterwards opposing each other, namely, —the ordinary diminution of temperature by the decline of day, and the gradual extinction and subsequent restoration of the sun's rays. In the earlier interval of the period of eclipse both combine to lower the temperature, but, later on, the descent of the sun and the gradual enlargement of his visible disc produce opposite effects, and we are thus prepared to find the fall of the thermometer not afterwards compensated for by the subsequent rise. At Prescott, the fall during the eclipse was 6°·5, and the subsequent rise only 0°·8; at Toronto, these quantities were 4°·6 and 3°·0; at Kingston 8° and 3°. The

lowest temperature occurred not at the period of greatest obscuration, but, as might have been anticipated, somewhat later —at Prescott, 16 minutes after the middle of annularity; at Kingston, about 12 minutes; and at Toronto, 20 minutes after the greatest obscuration.

The normal fall of the temperature at Toronto on that day from the beginning of the eclipse to the greatest obscuration is 1°·0, and that from the greatest obscuration to the end is 2°·2; so that the diminution and increase of temperature due to the obscuration and re-appearance of eleven digits of the sun's disc would be respectively 3°·6 and 5°·2, the mean of which is 4°·4—a result which is approximative only in so far as the actual march of the temperature of that day may have coincided with the normal: and the elimination of this possible discrepancy is precisely one of those points which can only be effected by comparison of similar results at many stations.

The effect on a thermometer with blackened bulb freely exposed to the sun's rays is of course much greater. At Toronto the fall was 23°·0, at Prescott 13°·0, at Kingston 16°—the minimum occurring in all at the greatest obscuration; the subsequent rise to the end of the eclipse was at these stations 12°·2, 7°·8, and 9°, the excess of the fall above the rise being due to the sun's descent in the heavens.

It may be mentioned that at the Observatory, Toronto, in addition to the usual photographic traces of the self-recording magnetic instruments, eye-observations of all the instruments were made consecutively during the eclipse, but no unusual disturbance of any of the magnetic elements occurred.

Among the most striking natural phenomena attending a solar eclipse are the changes in the colour of the sky and the aspect of terrestrial objects. Such changes are attested by observers on all occasions, but the precise nature of them varies considerably with the particular circumstances of the locality, the nature of the day, and, in no slight degree, depends also on the idiosyncrasy of the observer himself. Thus we find, in the historical records of different eclipses, from the year 840 A.D. downwards, that "the blue tint of the sky became a livid colour, mixed with a shade of purple;"[1] that "the solar light passed during the progress of a solar eclipse, from its ordinary white to yellow, then to orange, and finally, before complete immersion, the last rays were reddish;"[2] that the character of the complete obscurity was a "tint wan and livid, a shading of olive-grey, which threw over nature, as it were, a veil of woe;"[3] that "on the horizon over the sea line was a large band of red orange;"[4] and again, "on the horizon opposite the sun rose a belt of from 15 to 20 degrees in altitude, whose colour resembled that of red copper, while higher up, the sky was of a sombre violet-tinted azure."[5] In another account, we read that as the obscurity increased, the remaining daylight had a yellowish tinge, and the azure blue of the sky deepened to a purplish violet hue, and during the complete immersion, the heavens, in the neighborhood of the sun, were of a uniform purple grey colour, in the zenith of a purplish violet, and opposite the sun, broad bands of yellowish-crimson, intensely bright, pervaded large portions of the sky, while the sea turned lurid red.[6] Other observers note the increasing darkness to be accompanied by a peculiar greenish hue;[7] in the zenith the clear blue turning purple black;[8] and opposite the sun, upwards from the horizon, the sky being largely and brilliantly illuminated with rosy red;[9] or as others describe it, "with magnificent yellow-orange or amber colour, contrasting strongly with the dark purplish-grey of the sky overhead, while in the neighbourhood of the sun a sombre leaden hue prevailed."[10]

Equally striking are the various notices of the changes in the aspect of terrestrial objects. So far back as 1706, it was observed by Plantade and Clapiés, that "when eight digits were eclipsed, objects appeared of an orange-yellow, and at eleven and a half they assumed a red tinge." The attention of observers having been especially directed to this point by Arago, the eclipse of 1842 furnished numerous data from different quarters extremely curious and interesting. All agree that a little before the commencement of the total obscuration the colour of surrounding objects became livid, and, in particular, the faces of persons assumed a wan and cadaverous appearance, the precise tint, however, being variously represented; thus, in some we read that objects appeared slightly yellowish or reddish; in others, that the paleness partook of an olive or olive-green hue: again, that from a greenish tint they passed gradually to saffron according to some observers; to violet, according to others; described by another, as if they had been seen by a Bengal light. So the landscape of an extended plain had a greenish cast, and the waters of lake and river assumed a frightful leaden appearance, while the sea is described otherwhere as glowing with lurid red.

Before entering on the various explanations that may be offered for these phenomena, we may examine what was remarked in the present eclipse, bearing in mind that we can only expect in a partial eclipse indications, probably faint, of those great changes attendant on a total one.

From Kingston, we learn that "at the period of greatest obscuration, the appearance of the landscape under the sun was lurid, and seemed as if viewed through glasses of a neutral tint. The obscuration was very palpable, and quite different from the ordinary shades of evening. Nothing remarkable was observed in the portion of the heavens opposite the sun in the eastern horizon."

At St. Martin, "at 4*h*. 50*m*., till some time after the greatest obscuration, the heavens appeared of a pale yellow hue. . . A large mass of clouds (cum. strat.) lay on the eastern horizon, which increased in blackness as the light of the sun decreased."

At Toronto, "at the greatest obscuration (5*h*. 04*m*.) a dull red or brown tinge round the horizon, to E. and S.E., reflected so strongly as to affect the appearance of terrestrial objects, of individuals, and their dress."

At Prescott, a curious instance occurred of the variations that may happen in the description of the same phenomena of shade and colour by different individuals.

Some time before the annularity commenced, one of the observers detected a red tinge in the increasing darkness on the horizon towards the S.E., and called the attention of the rest to it, but all of them denied any perception of it. Thinking it might be an optical illusion arising from the continued use of a coloured glass, this person rested his eye for some time, and on again looking in that direction, was convinced of the existence of the tint still more strongly. It was again denied by the rest, who could see only a gray like that of early dawn. The observation was of course set down as doubtful, but is de-

1. Halley, 1715.
2. Brau, 1842.
3. Pinaud and Boigiraud, 1842.
4. De Passa, 1842.
5. Piola, 1842.
6. Hind, 1851.
7. Robertson, 1851.
8. Airy, 1851.
9. Airy, 1851.
10. Swan, 1851.

cisively confirmed by the evidence of several in the observations at Toronto.

As the annularity approached, the landscape assumed a peculiar sombre hue, differing sensibly, though in what it is hard to say, from the shades of evening, or of a sky overcast with clouds, and during the annularity that strange lurid appearance, so often remarked, rested on terrestrial objects, giving to the grey stone buildings of the Fort a greenish tinge, and making the faces of individuals look ghastly and corpse-like.

It will be collected from what has preceded, that the changes of coloration referred to, though varying in detail on different occasions, and even variously represented by different persons at the same time and place, present some features in which all agree, such as the red or orange tinge on the horizon, the purple gray of the zenith, and the lurid green of light-coloured terrestrial objects. The question arises—Can these circumstances be accounted for, considering them as due to the varying action of the sun's light on our atmosphere? or are we to infer that the quality of the sun's light is different at different points of his disc? To the latter we are able to reply in the negative; for in this case the solar spectrum formed by refracting the sun's rays through a prism would undergo modification in color during the progress of the eclipse. The experiment was tried on this occasion by Dr. Smallwood, who states that "the spectrum exhibited a very slight increase of the red ray," which is sufficiently accounted for by the descent of the sun towards the horizon. Conclusive as this is, another test of the same might have been afforded by an observation suggested by the Committee, namely—an examination of the coronæ formed occasionally when a light cloud or haze interposes before the sun's disc. The colors of these rings (first recognized by the celebrated Young as a problem of interferences on the undulatory hypothesis of light) would have varied from those of the uneclipsed sun; but the circumstances favourable to their occurrence appear to have been wanting on the present occasion.

Dismissing, then, the hypothesis of any sensible variation in the quality of the sun's light in different points of his surface, it remains only to see if the observed facts can be accounted for as atmospheric phenomena. The whole question of the illumination of the sky is one of great subtlety and delicacy, and to the sagacity of the great Newton we owe the fundamental idea of its explanation, namely—"that the particles of the atmosphere have no proper colour of their own, but that they more easily reflect the blue and transmit the red rays of the white solar beam." So that of a pencil of parallel rays falling on a spherical particle of air or vapour, one part is transmitted, another is reflected in all directions as if the particle itself were a source of radiant light; in the former, the colours towards the red end of the spectrum predominating; in the latter, those towards the blue. It is to this reflection or scattering we owe the general blue colour of the heavens, the illumination of twilight, and the diffusion of light in the daytime. "Were it not for this," says Herschel, "no objects would be visible to us out of direct sunshine; every shadow of a passing cloud would be pitchy darkness; the stars would be visible all day; and every apartment, into which the sun had not direct admission, would be involved in nocturnal obscurity." Suppose, now, a spectator to direct his sight towards one point of the sky, his eye will receive from the aerial particles along the line of vision, first—those rays of the sun which, falling on them after direct passage through the atmosphere, are reflected to the eye; secondly, those, also, which, having been already reflected one or more times among the whole mass of particles of the atmosphere, have also fallen on this line of particles, and been by them again reflected in the same direction as the former to his eye.

The colour of the spot of sky at which he looks will be determined by the combination of these two lights, which we may distinguish by the terms "direct" and "indirect;" the former being, under ordinary circumstances, much the stronger of the two, and giving the character to the colour. This direct light, as already stated, loses its blue by transmission and its red by reflection, so that the final tint, on reaching the eye, and by consequence, also, the colour of the sky, will depend on the length of path and the density and moisture of the strata traversed by it. Thus, under all circumstances, in a clear sky, the zenith will be decidedly bluer than the horizon, the blue tint diminishing as we descend, both on account of the smaller vertical height compared with the horizontal range of the air, and also on account of the increased density and moisture of the strata nearest the earth's surface.

Again, at mid-day, when the sun is at his highest, the length of path for the zenithal regions will then be the shortest, and the blue tint of the zenith will be stronger than at any other time of day, and on the horizon, for similar reasons, a grey tint prevails, often nearly white. As the sun descends, the blue in the zenith fades, and the red predominates on the horizon, till at sunset the *direct* light transmitted through the lowest strata of air, often charged with moisture, furnishes on the horizon, in the neighbourhood of the sun and extending from him on both sides, a brilliant red, which whitens towards the zenith, and may often be seen to assume, as we ascend, the successive colours of the spectrum from red to blue-gray. Opposite to the sun may often be seen a patch of red light, which attains its greatest intensity just as the sun sinks below the horizon, and is even more decided than that in the west, the rays forming it having twice had to traverse the lowest stratum of air and vapour. When the sun sinks below the horizon, the *direct* light is intercepted from the east by the interposition of the earth, whose shadow is projected on the sky in the form of a circular segment; the sky within this is illuminated solely by the *indirect* light which has proceeded by reflection through the higher strata, and is consequently blue, rendered still more marked by contrast with the surrounding red. When the sun has sunk, and the *direct* light is wholly cut off, the only illumination of the heavens is by the *indirect* which, as night proceeds, is given by more and more numerous reflections, and becomes in proportion more and more blue. Applying the same explanation to the effect produced by the opaque body of the moon interposing between the sun and spectator, we see that in a partial eclipse, the *direct* light being more or less cut off, the *indirect* becomes proportionally of more importance, and has more effect in determining the resultant colour of the portion of sky considered. It is also evident that its effect must depend much on the altitude of the sun at the time, and the position of the spectator in the shadow. In the zenith the *direct* light being intercepted more or less, we should expect the blue to be more decided, and if the sun be somewhat low in the heavens, this blue would be mixed with the *indirect* rays from the horizon, and thus acquire a purple tint. On the horizon, again, the part in deepest shadow loses not only its *direct* light, but also that portion of the *indirect* which is ordinarily furnished to it by the zenithal regions; its remaining illumination coming from strata lower down would necessarily show the red tint so constantly observed. For intermediate portions of the sky, the prevailing tint would

be intermediate to these, and much the greater portion of the heavens would be tinted with green, as we often see, in a fine sunset, the green commencing within 15° of the horizon. We are thus furnished with the clue to the various and even discordant appearances cited above—the lurid red on the horizon, the sombre purple of the zenith, the leaden sky, the green tint of the landscape, and the ghastly appearance of persons by means of this green tint (rendered more striking by contrast when projected against the " burning" horizon), and also the reddish tinge of objects when seen by this same light from the horizon reflected on them.

In the suggestions published by the Institute, it was remarked that we could not expect that " the effects described as produced on the animal and vegetable creation by the entire deprivation of the sun's light in a total eclipse will be at all noticeable in the present case." This expectation has been to some degree falsified by the event. Dr. Smallwood records that at the time of greatest obscuration " a melancholy stillness prevailed; sounds seemed more perceptible; frogs commenced their croaking, and my own fowls retired to roost, and did not re-appear that evening." At Prescott, some tame pigeons, which were flying about the fort, retired to their cote some time before the annularity commenced, and did not re-appear; a great number of martins had been also flying about during the earlier part of the eclipse, but during the annularity not one was visible; the various sounds of animated life were all hushed during this period, except the croaking of frogs, which went on with increased vigor.

In opposition to this, we find at Toronto that, at the greatest obscuration and throughout the eclipse, " birds are singing cheerfully on the trees and cows lowing," and yet the darkness could hardly have been perceptibly less at Toronto than at Montreal or Prescott.*

It was suggested in the Instructions, that it should be noticed whether a well-defined shadow of a cross or staff thrown on a wall, be subject to any flickering motion, especially about the edges, and whether any moving bands or patches of light are seen to traverse the wall or ground.

Neither of these phenomena was observed, and probably for the same reason, viz., that the diminution of light was not sufficient to admit of their becoming so marked as not to escape observation. These variations of light had been observed by M. Arago when the sun was shining on a screen under ordinary circumstances. He at once attributed the phenomena to the changes going on in the different strata of the atmosphere, by means of currents, variation of temperature, &c., and also perceived that the appearance ought to be more marked in proportion as a less amount of the sun's disc should remain visible. He accordingly desired several observers to direct their attention to a wall on which the sun was shiuing during the progress of the eclipse, but without telling them the result which he expected. The testimony borne by these persons was decisive; they all describe the sun's light as becoming *flickering* just before the commencement of the totality, and state that alternate bands of light and shade, in some cases of various colours, seemed to run over the surface of the wall; these were in some instances so marked as to attract the attention of children, who tried to run after and lay their hands upon them. The same phenomeua recurred at the end of the totality, lasting, however, only a few seconds. It is, therefore, quite possible that though the phenomenon in question did exist during the eclipse of 1854, and in a greater degree than during ordinary sunlight, yet the diminution of the visible surface of the sun may not have been sufficient to exaggerate the appearance to such an extent as to make it remarkable to an unpractised eye. The only peculiarity remarked by any of the observers, with regard to shadows, was that it was noticed at Kingston that when the annulus was formed, the double shadows cast by the sun were very perceptible.

It was, perhaps, scarcely to be expected that any trace of the moon's shadow should be seen in the present instance. Its appearance at the end of the totality of the eclipse of 1851 is thus noticed by Mr. Airy. He says, after describing the re-appearance of the sun, "I withdrew from the telescope and looked around; the country seemed, though rapidly, yet half unwillingly to be recovering its usual cheerfulness. My eye, however, was caught by a duskiness in the S.E., and I immediately perceived that it was the eclipse-shadow in the air, travelling away in the direction of the shadow's path. For at least six seconds this shadow remained in sight, far more conspicuous to the eye than I had anticipated." In the case of the annular eclipse, it is to be presumed that the atmospheric illumination was generally too great to admit of the shadow being thus visible.

Among the astronomical observations suggested in the Instructions are the following:—

I. The moon's limb appeared serrated at Toronto and at Kingston. The observer at Toronto remarks that at $4h.$ $35m.$, when six digits were eclipsed, " the edge of the moon in passing over the sun's surface, appears jagged or serrated;" and again, at $5h.$ 38 $m.$, " the edge of the moon on the sun's surface very jagged, the sun's disc and cusps well defined." In the report from Kingston we have the following, " The moon's limb was remarked as slightly serrated in passing over the sun's disc, the greatest amount of inequality being towards the extremity of the eastern limb. At Prescott, however, the limb, as viewed through telescopes of considerably higher power, appeared remarkably free from all irregularities. This appearance of a serrated edge is caused by the existence of large mountains on that part of the moon's surface, which forms the boundary of the hemisphere visible from the earth. We have other indications sufficiently decisive of the existence of such mountains on the lunar surface. For instance, were the moon's surface perfectly smooth, the line which divides the bright and dark portions of the disc, when partially illuminated by the sun, would be even and sharp; whereas it is perceptibly jagged, even to the naked eye; the mountains in the neighbourhood of the dividing line having the sun nearly in their horizon, and therefore throwing very large shadows; and, on the other hand, bright spots are often to be seen on the dark side of the

* When this paper was read at the meeting of the Institute, Prof. Croft made some remarks on this subject, which he has obligingly communicated to us, as follows:—

" Previous to the eclipse, I had carefully noticed the time at which the poultry in my yard went to roost; and having observed it for ten or twelve days, found that they all retired a few minutes before six, or about that time, excepting some Shanghaes, which were always active till seven, or even later. On the day of the eclipse, being busily engaged making such observations on the obscuration as I could, I forgot to look after the fowls, until about five or ten minutes after four, when, on looking round for them, I discovered they had all gone to roost. At this time, scarcely any difference was perceptible in the light of the sky, and yet the fowls were all sensible of it, excepting the Shanghaes, who, however, also vanished about half-past four. At half-past five, almost all of them were again running about the yard. I fancied, but I will not state positively, that I noticed a great diminution in the number of flies, which at that time of the day are generally very plentiful. I beg also to confirm your statement with regard to the ' ghastly appearance' produced; this was particularly remarked by a number of ladies who were using my telescope."

boundary, being, in fact, the peaks of high mountains on which the sun is shining, although his rays are intercepted from the valleys in the same neighbourhood. Again, when a star is occulted by the moon, it is sometimes seen to run along the extremity of the disc, alternately appearing and disappearing as it is successively hidden by the mountains on the edge, and allowed to shine through the hollows between them. These mountains may be much more considerable at one part of the circumference than at another: and although, speaking roughly, the moon always keeps the same face turned towards the earth, yet in consequence of her librations, and the different positions of observers, the portion which forms the boundary of her visible hemisphere will vary, though within small limits. Consequently, it is quite possible that the edge of the moon's disc might appear serrated during one eclipse, and smooth during another; but it is difficult to understand why at the same time the moon's limb should have appeared serrated to one observer, and to another, at a comparatively short distance from the former, perfectly sharp and smooth. This is the more remarkable, because, at Prescott, a phenomenon *was* observed which depends upon this mountainous boundary of the moon, viz., "Baily's beads." These have been observed both in total and annular eclipses. In the case of a total eclipse, just at the commencement of the totality, that is, just at the moment when the eastern limb of the moon is coming into contact with the eastern limb of the sun, the very narrow bright segment of the latter body becomes broken up into brilliant irregular portions called, from the person who first observed them, "Baily's beads." The same appearance is also observed at the end of the totality. This phenomenon is certainly a result of the unevenness of the lunar surface; the "beads" being nothing else than gaps between the mountains, through which the sun can still be seen. The Astronomer Royal thus describes their appearance at the beginning of the totality of the eclipse of 1851, pointing out very distinctly the cause to which he considers them due. He says, "I took off the higher power, with which I had scrutinized the sun, and put on the lowest power (magnifying about 34 times). With this I saw the mountains of the moon perfectly well. I watched carefully the approach of the moon's limb to the sun's limb, which my graduated dark glass enabled me to do in great perfection. I saw both limbs perfectly well defined to the last, and saw the line becoming narrower, and the cusps becoming sharper without any distortion or prolongation of the limbs. I saw the moon's serrated limb advance up to the sun's, and the light of the sun glimmering through the hollows between the mountain peaks, and saw these glimmering spots extinguished, one after the other, in extremely rapid succession." In the case of an annular eclipse, the same phenomena are observed, but in an inverted order. The first appearance of the beads is at the moment when the western edge of the moon is just detaching itself from the western edge of the sun. If the boundary of the disc of the former body were perfectly smooth, we should see the bright disc of the sun surrounding it gradually and continuously, until the whole surface of the moon became projected upon that of the sun. Instead of this, however, when the annularity has very nearly commenced, and consequently only a very small segment of the circumference of the sun is obscured, that remaining segment, instead of being gradually revealed, becomes suddenly bright in a number of points, with dark spaces intervening; the bright spots increase in size, and seem to run into each other, until the moon's limb is at length wholly surrounded by the bright disc of the sun. A similar appearance recurs at the end of the annularity, when the eastern limb of the moon joins the eastern limb of the sun. These beads were seen by one of the observers at Prescott, distinctly at the beginning of the annularity, and with less clearness at the end; and the fact that they were visible is sufficient to prove that, althought the moon's limb did not *appear* jagged in passing over the sun's disc, it really was uneven, and that it must have been in consequence of some peculiarity in the instruments or colored glasses employed that the serrated edge was not previously observed. The beads were not distinctly observed at Kingston, but we have the following remark in the report from that station, "On the first contact of the western limbs of the sun and moon, Baron de Rottenburg remarked a slight appearance of the light as it were running along the line of contact, but not with that degree of brilliancy or certainty which has been recorded on similar occasions."

Another indication of the unevenness of the surface of the moon appears in the fact, that at one time during the progress of the eclipse, the horn or cusp of the solar disc was observed at Montreal to be slightly blunted, which must have been caused by the existence of a large mountain just at that part of the moon's limb which, at the time in question, appeared to join the sun's limb. It has, indeed, been suggested that this appearance of bluntness in the cusp might be produced by a lunar atmosphere. The effect of such an atmosphere would certainly be to distort perceptibly the shape of the narrow crescent of light, when the eclipse was considerably advanced. The rays of the sun would be bent inwards by passing through this medium, and thus a small portion of the sun would become visible, which would not be seen if this lunar atmosphere did not exist, and the extremity of the bright segment would, in consequence, appear blunted. The existence, therefore, of a lunar atmosphere would account for such an appearance as that noted by Dr. Smallwood; but we must not infer from the phenomenon that such an atmosphere really does exist. As has been before remarked, the existence of a large mountain at the part of the moon's disc which intersects that of the sun would also account for the appearance: and that this, and not the former explanation, is the true one, is evident from several considerations. In the first place, there is pretty conclusive evidence, from other sources, that no such atmosphere does exist in the moon: no atmosphere, that is to say, capable of sensibly refracting light passing through it. Thus, in the case of the occultation of a star by the moon, if a lunar atmosphere existed the star would continue to be visible by reason of the refraction after the moon's disc was really interposed, so that the disappearance of the star would be postponed in consequence of the existence of such an atmosphere; and as the time of re-appearance would be anticipated by the same amount, the observed time of occultation would be shorter by twice that amount than the time given by calculation. No such difference, however, is observed. Again, if the moon were surrounded by an atmosphere containing any appreciable amount of vapour, the extinction of a star's light by an occultation ought to be gradual, and very faint stars ought to become invisible before the proper time of occultation, as the moon's atmosphere would be sufficient to intercept their light. This is also contrary to what is observed; for, during an eclipse of the moon (which, owing to the absence of diffused light, is the most favourable time for making such observations), stars of the tenth magnitude are seen *suddenly* extinguished by the interposition of the moon's disc. And, in addition to this evidence from other sources, it is clear, that in the case of a solar eclipse, any alteration in the shape of the bright crescent produced by an atmosphere about the moon, would be of a

comparatively steady and permanent character, being subjected only to variations due to changes in the state of that atmosphere; whereas, on all occasions where a blunted horn has been observed, it has been only a transient phenomenon. Thus, in the eclipse of 1842, M. Arago notices that each cusp was repeatedly blunted and recovered its natural form. Again, there appears to be no evidence of any prolongation of the bright segment, which would certainly be produced by the existence of such an atmosphere. And, what is perhaps the most conclusive evidence of all, eclipses have been repeatedly observed without the cusps being seen to be blunted at all; as was the case in the eclipse of 1854, the cusps having appeared perfectly sharp, and free from all distortion throughout the eclipse to the observers at Prescott, Kingston and Toronto. We may, therefore, safely ascribe the phenomenon observed by Dr. Smallwood to the existence of a considerable mountain on the portion of the moon's disc forming the extremity of the cusp.

II. At 4*h.* 49*m.* 15*s.* a minute bright spot was seen at Kingston on the surface of the moon, near the eastern cusp. Several theories have been suggested to account for the appearance of such spots, which have been frequently observed. The first mention of them is by Ulloa, who, in the total eclipse of 1778, "saw in the N. W. region of the moon a luminous point, shining successively as brightly as a star of the 4th, 3rd and 2nd order." This phenomenon received from him a very strange explanation, viz., that the moon is penetrated by a sort of long tunnel, through which the sun's disc could be seen. And the same hypothesis, slightly modified, was adopted by M. Valz, who observed the eclipse of 1842 at Marseilles. It seems strange that such hypotheses could be gravely set forth. It is obvious that, if such were the real cause of the appearance of these luminous spots, instead of being momentary and variable phenomena, they would retain their brilliancy at least for some considerable period; and, moreover, if such gaps existed, they could scarcely fail to be observed as *shadows* on the full moon, considering the magnitude of the astronomical instruments now employed. It has also been supposed that the appearance of such bright spots might be due to the existence of active volcanoes on the moon's surface, which several astronomers have fancied they have seen. Thus Hevelius asserted that the mountain known as Aristarchus "appeared reddish and seemed to burn"; and several other astronomers—among whom we may mention Sir W. Herschel—have recorded similar appearances. It seems, however, probable that the volcanic character of these mountains cannot be maintained. The flickering appearance of the light—on which the hypothesis materially depends—seems wholly due to atmospheric causes, as it is not observed when the sky is clear, and the air still. The other grounds on which the mountain in question has been conjectured to be a volcano, are, that it has been distinctly seen during a lunar eclipse, and that it is often very conspicuous at the time when the moon is nearly new, and when the portion of her disc not illuminated by the sun is seen by aid of the light reflected from the earth. In the latter case, if we suppose the mountain to have a smooth table land at its summit, and the sides to be rugged and broken, it is easy to understand that the plateau at the top would reflect more light than the surrounding regions, and so appear brighter. But it seems almost impossible to account for the continued brightness during a lunar eclipse, when there is actually no light falling upon the moon, except by supposing the spot in question either self-luminous, or, at any rate, capable of giving out during the darkness the light previously absorbed. On either supposition the appearance of a bright spot on the moon during a solar eclipse might be accounted for, supposing it to have been observed by several persons, and for some considerable time. But it seems that whenever such appearances have been observed, they have been temporary, and that they have been noticed only by a few observers. Thus, in the eclipse of 1842, neither Mr. Airy, nor Mr. Baily, nor M. Arago perceived any such bright spots; and, though they were observed by others, the observations do not present accordance either in time or position—which evidently suggests the enquiry, whether these appearances may not be optical illusions. That a person might be deceived in this respect is evident from the fact that one of the observers at Prescott repeatedly thought he saw such a spot, but as on moving the telescope the spot moved with it, it was at once evident that it was due to some particles of dust or accidental inequality on the object-glass scattering the sun's rays.

III. None of the observers of the eclipse of 1854 succeeded in seeing the portion of the moon's disc exterior to that of the sun. It was seen by M. Arago during the eclipse of 1842, and is thus described by him:—"About 40 minutes after the commencement of the eclipse of July 8th, at 5h. 35m. by our clock, I saw the outline of the moon delineated upon the heavens. It formed accurately the prolongation of the dark circular arc which another portion of the same limb traced on the surface of the sun, and joined it at two points on the bright limb of the latter body." The same appearance is thus noticed by M. Flaugergues, who observed the eclipse at Toulon. "Towards the middle of the increase of the eclipse, the disc of the moon was visible about 25° beyond each of the points of intersection of the circumferences. When the eclipse amounted to eleven digits, all the disc of the moon became visible."

In the Instructions printed by order of the Institute, it was pointed out that this phenomenon would certainly escape observation, if the lenses of the telescope were not perfectly polished and scrupulously clean, and it was probably chiefly to the fact of the former condition not being fulfilled, that we must ascribe the failure of the observers in this respect. To explain why these precautions are essential to the success of the observation, it will be necessary to point out the mode in which the moon's disc does become visible under these circumstances.

The explanation which would at first offer itself, and which was assumed to be the true one by some observers in 1842, is that the moon's disc might be rendered visible by the twice-reflected light of the sun, which is called by French astronomers, "la laumière cendrée," and which has been by some English writers termed "earth-shine." That this light is, under certain circumstances, sufficiently strong to render the moon's disc visible, is evident to any one who has remarked the appearance of the moon when very young, when not only the small crescent illuminated by the sun's direct rays is visible, but we can also see the remainder of the disc of a peculiar grey colour. This is owing to the fact that at that time the earth as seen from the moon is nearly full, and that the light reflected from the earth to the moon is strong enough, when reflected again to us, to render visible the part of the moon not illuminated by the direct rays of the sun. Is it possible, then, that when the eclipse has begun, the portion of the moon exterior to the sun should be rendered visible by this light? In order to answer this question, it will be necessary to ascertain under what conditions an object becomes visible, either by the naked eye or through a telescope. It is evident that we have to take into account something besides the actual amount of

light coming from the object, since the same degree of illumination which, under certain conditions, will render the body visible, will under other circumstances, fail to produce any sensible impression. Thus, for example, the lumière cendrée, or earth-shine on the moon, which is perceptible by the naked eye after sunset, cannot be detected with the aid of a telescope while the sun is above the horizon. This difference is due to the dispersive power of the atmosphere. When the sun's rays fall upon any one of the minute particles of the air, they are reflected in all directions, and the particles, as has been before remarked, becomes virtually a luminous point. The result of these reflections at all the particles of the air is the appearance of the bright blue sky; and when we turn a telescope towards any portion of the sky the field of view is illuminated by what we may call the light of the sky, that is, by the light of the sun which has been reflected from the particles of the atmosphere. If, now, we direct the telescope, during daylight, to a heavenly body, the field of view will be illuminated *generally* by the light of the sky; and the part of the field where the image of the body is formed will receive the proper light of the body in addition to the light of the sky; consequently, the visibility of the body will depend upon the excess of light upon this spot, above the general illumination of the field; and it is obvious that this excess will bear a ratio to the whole illumination, which will vary with the intensity of the light of the sky. In order that the image may be visible, it is found by experience that this excess must be equal to at least one-sixtieth of the general illumination; if this is not the case, though the image of the body is really formed upon the field of view, our eyes are incapable of distinguishing it from the surrounding parts of the field. Thus the greater the brightness of the field produced by the atmospheric reflection, the less will be our chance of seeing a luminous body situated beyond the atmosphere. As an illustration of this may be noticed the power of seeing the stars by daylight through a long telescope or tube. When the eye is unprotected, the retina is illuminated by rays reflected from nearly half the atmospheric particles above the horizon; whereas, when we look through a long tube, it is only from particles situated in a comparatively small region that the eye can receive light, and thus the light of the star becomes of greater importance—bears a larger proportion to the whole illumination—and may, if the tube be long enough, become as much as one-sixtieth of the general illumination, and thus render the star visible.

To return, then, to the moon's disc as seen beyond the sun during the eclipse. Is it possible that the lumière cendrée can be the cause of its being thus visible? If so, that light must be equal to at least one-sixtieth of the light of the sky received on the field of the telescope in the neighbourhood. Now, this twice reflected light is very feeble, and the exterior portion of the moon was seen by Arago in 1842, when not more than half the sun's diameter was eclipsed, and when the atmospheric illumination must therefore have been far more than sixty times the lumière cendrée. Consequently this explanation of the phenomenon is inadmissible. In fact, according to Arago's explanation, which seems almost certainly the true one, the moon's disc is visible under these circumstances, not because the illumination of her image is greater than that of the surrounding field, but because it is less so. It is seen just as the portion of the moon which is between us and the sun, as a dark object on a bright ground. This bright ground is an object of considerable interest as proving almost conclusively the existence of a non-luminous atmosphere of the sun surrounding the luminous envelope, and capable of reflecting the light proceeding from the latter. The light reflected by this outer atmosphere is so feeble that under ordinary circumstances we cannot perceive it, because it bears so small a proportion to the diffused light of the sky: and even during the progress of an eclipse, although the diffused light becomes more and more feeble as the moon's shadow envelopes more and more of the atmosphere, yet so long as *any* of the rays of the sun are not intercepted, the light of the sky is strong enough to prevent our seeing that reflected by the external envelope of the sun. When, however, the eclipse becomes total, all the direct light of the sun is cut off from the portion of the atmosphere through which we are looking, and the only illumination of the sky in the neighbourhood of the sun is that produced by rays which have been already reflected at distant parts of the earth's atmosphere. The illumination thus produced is very feeble, and the light reflected by the sun's atmosphere then becomes visible as a broad ring of light or corona, surrounding the dark body of the moon, and diminishing in brightness as it recedes from the sun's disc; but the moment the sun re-appears, this corona vanishes again, so that there is no chance of seeing it directly during any partial or annular eclipse however large. When, however, about half the sun's disc is eclipsed, the illumination of the field of a good telescope, arising from the reflected light of the atmosphere, is considerably reduced, and the excess of the illumination of the image of the corona above that of the dark body of the moon becomes perceptible, and renders the outline of the latter body visible. The truth of this explanation is strongly confirmed by the fact that the exterior portion of the moon is most distinctly seen *near* the sun's limb; which is in accordance with the theory, inasmuch as the corona, which forms the bright ground, is more strongly illuminated in that neighbourhood than at a greater distance.

We are now in a position to explain why this observation would very probably fail, if the object glass of the telescope were imperfectly polished, or had any particles of dust or moisture adhering to it. If the object glass were perfectly transparent, every ray falling upon it (provided its path was not inclined at too large an angle to the axis of the lens) would be entirely refracted in its own proper direction. The illumination, therefore, of the field of view, so far as it was due to the light reflected by the atmosphere, would proceed from a comparatively small patch of the sky surrounding the point to which the axis of the telescope was directed: rays proceeding from other parts would, after refraction, be so much inclined to the axis as to strike the blackened sides of the tube of the telescope, and so be absorbed and lost; so that such rays would contribute nothing to the illumination of the field. Let us suppose that with such a glass the dark exterior portion of the moon's disc can just be distinguished; let us call the atmospheric brightness 60; this will be the illumination of that part of the field where the moon's image is,* the part immediately surrounding this receives also the light of the corona, and since it is *perceptibly* brighter than the moon's image, the number expressing its illumination must be at least 61. Now if we suppose the object glass of the telescope to be imperfectly polished, or not perfectly clean, the rays coming from remote parts of the sky will throw an additional light upon the field of view; for whenever one of such rays falls upon an opaque spot or a speck of dust on the object-glass a portion of it will be scattered in all directions, making the spot virtually a new source of

* Strictly speaking, the moon's image would be illuminated by the lumière cendrée, as well as by the light of the sky; but the former is so inconsiderable in amount, that it may beo mi tted.

light, a portion of which will fall upon the field of view. Suppose we denote by the number 10 the additional illumination of the field due to this cause; then the brightness of the moon's image will be $60 + 10 = 70$, that of the surrounding image of the corona $61 + 10 = 71$. The excess, therefore, of the brightness of the latter will be now only one-seventieth of the general illumination, which, as we have seen before is not sufficient to render the difference perceptible. * On the other hand, the chance of succeeding in the observation would have been materially increased by placing a diaphragm with a small aperture in front of the lens, thus protecting it from a great portion of the extraneous rays. M. Arago in his account of the total eclipse of 1842, gives a remarkable instance of the way in which the possibility of making this observation depends on the character and condition of the telescope. He was observing at Perpignan, in company with MM. Mauvais and Laugrier, and was himself at once struck with the phenomenon, which he had not expected. He directed the attention of his fellow-observers to it, but it was only with difficulty that M. Mauvais could detect it by means of his telescope, while M. Laugrier's would not give it at all, though both those gentlemen saw it distinctly in M. Arago's instrument. The telescopes used at Prescott had been carefully cleaned; but it is very difficult to keep an object glass, and still more an object mirror, perfectly free from all moisture. And, besides, it must be remembered, that no amount of care in cleaning could have ensured the success of the observation, if the object-glass or reflector was imperfectly polished. It is to be regretted that the precaution of placing a diaphragm in front of the object-glass was omitted, as this might very probably have rendered the phenomenon visible.

In conclusion, we may be permitted to observe, that a partial eclipse, however large, fails in exhibiting most of those astonishing phenomena which render a total eclipse the most striking of all celestial occurrences; and that in proportion as the magnitude of the phenomena decreases, so does the difficulty of observation increase. Considering also the shortness of the period to which the manifestation of the phenomena is confined, and the fewness of the opportunities that one person's lifetime affords for such occurrences, if any disappointment be felt that more was not accomplished on the present occasion, we would refer to a remark made by Professor Smith of Edinburgh, on the eclipse of 1851. He says, "on asking a worthy American, who had come with his instruments from the other side of the world, pointedly to observe the eclipse, what he had succeeded in doing? He merely answered, with much quiet impressiveness, that if it was to be observed over again, he hoped that he would then be able to do something, but as it was he had done nothing; it had been too much for him."

* This illustration is not strictly accurate, inasmuch as the effect of a film of dust or moisture on the object glass would be not only to increase the general illumination of the field, but to *diminish* the direct light received from the corona and the sky in the neighbourhood. It will be seen, however, that if we take this into consideration, the effect of the film in preventing our seeing the moon's disc projected on the corona will be increased. Thus, if we denote by a, the general illumination of the field, and by b, the additional light of the corona when the object glass is clean, the ratio of the excess of brightness of the image of the corona, to that of the portion of the field where the image of the moon is formed, will be $\frac{b}{a}$; when the general brightness of the field is increased by a quantity, c, in consequence of the interposition of a film on the object glass, the corresponding ratio will be $\frac{b}{a+c}$ the *difference* of the brightness remaining the same. This is obviously less than the former ratio. If, now, we take into account the effect of the film in diminishing the direct light, since the light of the corona and the atmospheric illumination will be diminished in the same ratio, we may write ma and mb for a and b, m being some proper fraction. Thus the ratio on which the visibility depends, will become $\frac{mb}{ma+c}$ which is less than $\frac{b}{a+c}$, and so, *a fortiori*, less than $\frac{b}{a}$.

Note on the Object of the Salt Condition of the Sea.

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For what beneficent purpose has the great Creator of all things ordained that the sea shall be salt? To this often mooted question, no satisfactory answer has hitherto been returned. So far as I can ascertain, the following suggestions are all that have been proposed as yet in elucidation of the subject: First, that the sea is salt, in order to preserve it in a state of purity. Secondly, in order to render the water of greater density, and consequently to impart a greater buoyancy to bodies floating in it. And thirdly, in order to cause its freezing point to be lower than that of fresh water, and hence to preserve it from congelation to within a shorter distance of the poles than would otherwise be the case.

The first suggestion is scarcely tenable, because, without the intervention of other conditions, the amount of saline matter present in the sea is not sufficient to prevent the putrefaction or decomposition of organic bodies. In many salt marshes and on sheltered coasts, it is well known for instance, that after heavy gales at sea, accumulations of sea-weed frequently collect to such an extent as to occasion by their decomposition the most injurious miasma. During calms, again, on low tropical coasts, gaseous emanations arising from the decomposition of animal matter in the sea, have often been remarked. In these and other similar cases, it is to be borne in mind, however, that the decomposing matters are present in unusual quantities under the influence of peculiar or temporary causes. Under ordinary conditions, it has now been satisfactorily shewn that organic impurities—and these only can affect the present question—diffused through a vast body of moving water, whether fresh or salt, become altogether lost, and with extreme rapidity: so much so, indeed, as apparently to have called forth a special agency to arrest the total destruction of organised matter in its final oscillation between the organic and inorganic worlds. I allude to the myriads of microscopic creatures which inhabit all waters, and whose primary function is ably surmised by England's great anatomist, Professor Owen, to be that of feeding upon, and thus restoring to the living chain, the almost unorganised matters diffused through their various zones of habitation. Not only do we find these creatures in every stagnant pool, but the sea itself teems with them in all their varied types. "The application of the microscope," says Humboldt, "increases in the most striking manner our impression of the rich luxuriance of animal life in the ocean, and reveals to the astonished senses a consciousness of the universality of life. In the oceanic depths, far exceeding the height of our loftiest mountain chains, every stratum of water is animated with polygastric sea-worms,

Cyclidiæ, and Ophrydinæ. The waters swarm with countless hosts of small luminiferous animalcules, Mammaria (of the order Acalephæ), Crustacea, Pteridinia, and circling Nereides, which, when attracted to the surface by peculiar meteorological conditions, convert every wave into a foaming band of flashing light."* These creatures preying upon one another, and being preyed upon by others in their turn, the circulation of organic matter is kept up, and carried through its appointed rounds. If we do not adopt this view, we must at least look upon the animal infusoria, the foraminifera, and many other forms of higher types of organisation, as scavenger agents appointed to prevent an undue accumulation of decaying matter; and in either case, so far as regards the object under discussion, the oceanic waters might have been as well fresh, as salt.

According to the second suggestion, the sea holds saline matter in solution, in order to render it of greater density. The superior density of sea-water as compared to fresh, undoubtedly plays an important part in many of the physical phenomena of which the ocean is the stage. A greater counterpoise is thus necessarily offered to lunar and other cosmical attractions; and the effects produced by winds and atmospheric disturbances must be modified also by this principle to no slight extent; but causes such as these, when considered in their fullest relations, can scarcely be considered adequate to meet the entire solution of so vast and grand a problem as that which is manifestly involved in the salt condition of the sea. Neither can the third supposition, as given above, be considered of greater value in this respect, because the difference between the freezing points of fresh and sea-water is under 4° Fah.; and hence, with the present distribution of land and water, and still less probably with that of former geological epochs, no very important effects would have resulted from this cause, if the ocean had been fresh instead of salt. So far as regards the habitable portions of the world for instance, the present difference would be next to nothing. I do not mean to imply, nevertheless, that this principle may not be without some secondary bearings on the phenomenon in question; but I do not consider it sufficient for the complete elucidation of the same.

The suggestion which I have now to lay before the Institute, as an attempt to explain the object in view—although confessedly not free from certain difficulties—will be found, I think, of a far more satisfactory character than those hitherto advanced. As already mentioned, I am not aware of any previous application of the principle which it embodies, to the solution of the present question. Without further preface, then, I may state that I regard the salt condition of the sea *as mainly intended to regulate evaporation*, and to prevent within certain limits, an undue excess of that phenomenon under the influence of any disturbing causes that might from time to time arise. It has been long known that different liquids boil at the same atmospheric pressure, under very different degrees of temperature; and that, of two saline solutions, the more strongly saturated requires the higher temperature to be raised to the boiling point. In like manner, evaporation at natural temperatures, other conditions being equal, proceeds far more slowly from saturated than from weak solutions; and, necessarily, more slowly also from these latter, than from ordinary water. In sea-water we have, as a mean, about three and a half per cent. of solid matters : 2·6 of this, on an average, consisting of chloride of sodium.

* Cosmos, vol. 1.

In order to observe the effects produced in retarding evaporation by so small a quantity of solid matter in solution, but without attempting to imitate the complex composition of sea-water, I placed a weighed quantity of ordinary rain water, and the same holding in solution 2·6 per cent. of Na Cl, in porcelain vessels of equal diameter; and exposed the two, side by side, to spontaneous evaporation: re-weighing them every twenty-four hours for six days. The experiment was then repeated, but with an exchange of vessels, so as to eliminate any errors that might arise from a slight difference in the diameters of the capsules employed. The results of each set of experiments were strikingly in accordance. The mean results of the two weighings, reduced to their per centage quantities, are given in the annexed table. Column A shews the evaporation loss resulting from the water. Column B, the same from the water of the salt solution: the amount of salt being deducted throughout as a constant quantity, and its weight confirmed by evaporation and re-weighing at the close of the experiment. Column C exhibits the excess of evaporation of A over B.

Hours.	A Loss from the Rain Water.	B Loss of Water from the Salt Solution.	C Excess of loss of A over B.
24	8.83	8.29	.54
48	19.12	18.08	1.04
72	26.63	25.17	1.46
96	30.82	29.05	1.77
120	39.00	36.76	2.24
144	44.99	42.43	2.56

An excess of 0.54 per cent. in twenty-four hours, in the evaporation of fresh water over water containing 2.6 per cent. of Na Cl, may seem at first sight of little moment; but when we consider that this arose from a surface under two inches square, we may easily conceive how enormous would be the difference between surfaces of fresh and salt water so vast as that of the present ocean, even; and so exposed over wide areas to evaporation-tending influences. Besides which, it must be remembered that the salt solution of the above table, contained at the commencement of the experiment, 1 per cent. less of solid matter than that present in the waters of the sea. It will be remarked, that as the salt solution becomes more and more concentrated, the excess of evaporation of A over B becomes higher and higher.

Here then we have a self-adjusting phenomenon; one of those admirable contrivances in the balance of forces, which an attentive study of nature reveals to us in every direction. If, other conditions being the same, any temporary cause render the amount of saline matter in the sea above its normal value, evaporation goes on the more and more slowly; and, on the other hand, if this value be depreciated by the addition of fresh water in undue excess, the evaporating power is the more and more increased; thus aiding time, in either instance, to restore the balance.

In conclusion I would observe, that the consideration of this principle may shed some further light on the geographical distribution of fresh and salt-water lakes on the present surface of the globe.

On the Transfusion of Milk, as practised in Cholera, at the Cholera Sheds, Toronto, July, 1854.

By James Bovell, M.D., Trin. Coll., Toronto.

(*Read before the Canadian Institute, January 27th*, 1855.)

Mr. President.

As I am quite aware that the Council of the Institute, as well as many of its members, wish to confine within proper limits the introduction of purely professional matters at the usual evening meetings, I have endeavoured to divest the subject which I purpose to bring before you this evening, as much as possible, of what you might consider its technical features; and instead of presenting to the Society a Report on the Cholera of 1854, I now venture to claim your attention to a single fact connected with that visitation,—one which I believe will be received by the members of the Institute with interest.

The possibility of saving human life by the transfusion of new blood into the system is not of very ancient date, and I believe that the records of antiquity furnish us with no instance of the introduction of blood into the system by operation. It was however practised, says Dr. Rhamsbotham, "by some in the last century; and some physiologists contend that the operation of transfusing medicated fluids, and blood itself, into the system of man, is of very remote origin; and they ground their supposition on some passages in the ancient poets." Thus Ov'd represents Medea as renewing the youth Œson by injecting the juice of herbs into his veins.

> "Quod simul ac vidit, stricto Medea recludit
> Ense senis jugulum: veteremque exire cruorem
> Passa replet succis. Quos postquam combibit Œson
> Aut ore acceptos, aut vulnere, barba, comœque
> Canitie posita, nigrum rapuere calorem."

This is no warrant for such a belief; and the probability is, that the fancy originated, not in any practice then pursued, but merely in an adventurous flight of poetry. It has been even supposed that in these early times blood was actually transmitted from one person to another, and a second passage in the same author, where he describes Medea's fiend-like deception practised upon the unsuspecting daughters of Pelias, has been quoted in proof.

> .... Quid nunc dubitatis inertes?
> Stringite, ait, gladios, veteremque haurite cruorem
> Ut repleam vacuas juvenili sanguine venas.
>
> Lib. vii.—5.

That these lines will not bear any such interpretation, the whole context, and the pretended sanitary preparations she makes, abundantly testify.

My relative, Dr. Leacock, in his Inaugural Thesis, published at Edinburgh, in, I think, 1816, again directed the attention of physicians to the real benefits which might be expected from the employment of such means for the restoration of life; and his opinions meeting with a warm advocacy from the justly celebrated Dr. Blundell, the operation of transfusion received an impress which it has never entirely lost. Various physiologists have, since the re-introduction of transfusion by Dr. Leacock, performed on the lower animals experiments, with the view to ascertain how far the blood of one animal may be substituted for that of another. As might have been expected, it was soon discovered that it was impossible to so far pervert the laws of physiology as to build up tissues from blood formed for the support of structures typically distinct; accordingly the law has been established, that an animal can only be restored to health by the introduction into its veins of blood taken from one of its own species. But intelligible as this law is, it is, nevertheless, found, that many conditions contribute to its successful working. Constituted as blood is, possessing a highly complex organisation, consisting of many parts—organized solids and fluids, and inorganic salts, wonderfully and inseparably joined together, living very quickly and dying as instantly, in obedience to laws which govern its origin and death—blood cannot be for any appreciable time removed from the circulatory condition without undergoing change. It is a completed organism when withdrawn from the body of the animal; already has it lived out more than half its time, and all its tendencies are not to live on, but to die out: hence experiment has shewn that even with the blood of the same animal the effects of its transfusion have not been invariably satisfactory, and various propositions have been made to modify the introduction of the blood, in order to render it better fitted for the end in view. Thus the French philosophers have endeavoured to show that the de-fibrination of the blood was more likely to secure the benefits sought to be obtained, than when the whole organized compound was employed. Be this as it may, it is quite certain, that in case of epidemic visitations, which cut down, not an individual here and there, but which decimate a population, be transfusion never so successful, yet it would be an impossibility to employ it on a general scale, since the physician would not be justified in depriving the as yet unattacked man, of blood, every drop of which he may require shortly himself, even if it were possible to induce the disaffected to part with what is really under such a condition to them "their life's blood."

The appreciation of this truth evidently led our authorities to introduce other menstrua, and as Animal Chemistry pointed out in the destroying discharges the presence of the saline constituents, it was thought advisable to inject into the system a supply of similar material to fill up the place of that drained away. That this plan has been occasionally successful experiment fully attests; but it is nevertheless admitted, that it has not fulfilled the expectations of its originators. In the first place, this doctrine fails to take cognizance of that portion of the blood which remains in the vessels; it fails to recognise the prime fact that the serum and salts of the blood are drained away, not so much in consequence of changes which have ensued in the vascular canals, as from a tendency in the blood itself to separate into its constituent parts—in short, to die. The introduction, therefore, of the saline ingredients into the body is not a restoring to the blood that which it had lost, but it is a restoring to the system of a part only of its usual circulating pabulum, the thick, black decaying blood-corpuscles being altogether unfit to carry on the vital processes requisite for the maintenance of the animal fabric. Thus reasoning, the thought suggested itself that nature herself provided us with the means of accomplishing the renovation of the blood, and that we had prepared ready for our use a liquid possessing the requisite qualities of a blood forming fluid, and, above all, that which no art or power of man could bestow, viz., vitality—a compound mixed in the great laboratory of life.

The experiments performed by M. Magendie were, however, not very encouraging, and tended rather to throw a shade of doubt over the utility of milk as an agent in transfusion. This distinguished physiologist injected various substances into the arterial system of dogs, and amongst them milk, the results of which was by no means satisfactory.

In Mr. Hassall's very excellent work on the Microscopic Anatomy of the Human Body, in the chapter on the blood, the following remarkable observations, cited from M. Donne's Papers, occurs:—

"Now, with regard to actual experiments with milk, we have

the testimony of M. Donne, that about two hours after its injection, rabbits, birds and dogs have been opened, 'I have collected,' he says, 'the blood in the different organs, in the lungs, the liver, the spleen, and everywhere I have found the blood containing a certain number of white globules in all stages of formation, and of red globules more or less perfect: invariably the spleen has presented to me special circumstances, so established and constant that it behoves me to mention them.' M. Donne further adds, 'that he believes that he has also traced, by direct observation and experiment the transformation of the minute oily and fatty particles found in the milk into white globules.' He injected numerous animals, birds, reptiles and mammals with various proportions of milk; and, strange to say," observes Mr. Hassall, "the creatures thus experimented upon experienced no injurious effect beyond a momentary shock, with, however, the single exception of the horse, to which the experiment proved fatal in seven different cases. If almost immediately after the injection of milk, a drop of blood be withdrawn from the system at a distance from the point where the milk was introduced, a number of the globules of the milk may be detected quite unaltered, and which may be recognised by their general appearance, their smaller size, and, lastly, by the action of acetic acid, which dissolves the red globules, renders apparent the granular texture of the white, but leaves untouched the molecules of the milk. If the blood be again examined, at about the expiration of two hours, the smallest milk globules will be seen to have united themselves with each other by threes and fours, and to have become enveloped, by circulating in the blood, in an albuminous layer, which forms around them a vesicle analogous to that which surrounds the white globules; the largest remain single, but are equally enveloped in a like covering. These soon break up into granules, in which state the milk globules of the blood bear a close resemblance to the white globules of the blood, from which finally they are not to be distinguished. The blood, Donne then remarks, 'shows itself very rich in white globules, but little by little these undergo changes more profound; their internal molecules become effaced and dissolved in the interior of the vesicle, the globule is depressed, and soon it presents a faint yellow colouration: they yet resist better the action of water and acetic acid than the fully formed blood globules, and it is by this that they are still to be distinguished. At length, after twenty-four hours, or at latest after forty-eight hours, matters have returned to their normal state; no more milk globules are to be seen, the proportion between the white and red globules has returned to what it ordinarily was.' In only one instance have I had the opportunity of noticing the changes spoken of by Donne, and that in the case of the man J. Pickles. He died about fourteen hours after transfusion, and I procured some blood from veins in the feet, and from the opposite arm; on submitting this blood to the microscope it was found to be loaded with white globules, presenting one of the best marked cases of Leucocythemia I ever saw. I failed, however, to notice a single milk globule; the red-corpuscles were very jagged."

Now, by reference to the Tables of Analysis of Milk and Blood by Simon and Mulder, we note the very close relationship which exists between them, and couple with this the facts as observed by Donne, viz., the evident convertibility of milk into blood, and the conclusion is almost irresistible that it must be a valuable agent for transfusion. Yet we had no precedent to direct us; and although I searched all the medical records within my reach I could not find a single case to guide us.

It will be noted by the Institute, that it was on the 10th of July, 1854, that the first case of transfusion with milk was effected in Toronto. In the *Association Medical Journal*, edited by Dr. Rose Cormack, under date Sept. 1st, 1854, the following letter, from William Bird Herapath, M.D., F.R.S., is published:—

On the Employment of Injections of Milk, or Milk and Water, into the Peritoneal Cavity, Cellular Tissue, or Venous System, in the Collapse of Cholera.

Sir,—In a paper read to the East Surrey Cholera Society, and published in the last number of the *Association Journal*, by Dr. Richardson, a proposal is made to inject the peritoneum and cellular tissue of cholera patients in the stage of collapse, with large quantities of water, for the purpose of rapidly supplying the loss of serum experienced by the excessive discharges from the intestinal mucous membrane. This extremely philosophical and ingenious suggestion is certainly highly deserving of a mature consideration, and a careful digest of properly conducted experiments. But it has occurred to me, whilst reading these remarks, that the injection of a fluid more closely approaching the character of serum in its chemical constitution would be more likely to give permanent benefit, and avoid the chances of destruction of the blood-corpuscles, occasioned by the difference existing between the specific gravity of their contents and of the rapidly imbibed water.

The most readily obtained liquid, having all the qualities we can desire is most assuredly cow's milk; it is always at hand in any quantity, whilst its tendency to coagulate may be obviated by adding a little solution of carbonate of soda or potassa, perhaps about one scruple of the salt to a pint of milk would be sufficient.

The only difficulties about the matter, would be the adulterations to which it may be subjected by fraudulent dealers, and the accidental presence of foreign bodies. Investigations at home and abroad have however shown that nothing enters more largely into the adulteration of milk than water. This is of no importance; but were the world-renowned "chalk and water" compound employed, fatal consequences would assuredly follow.

The entrance of foreign bodies into the circulation, or into the cavity of the peritoneum, or the muscles of the cellular tissue, may be easily prevented by attaching a fine muslin or gauze filter, or seive, to the mouth of the injecting syringe. It remains to be proved whether this fluid would be absorbed by the peritoneal vessels as readily as water, or with sufficient facility to be of service.

The specific gravity of good pure milk varies from 1.041 to 1.033 or 1.020; serum varies from 1.026 to 1.037, and even 1.050, according to the presence of health or disease. Now to produce the difference in specific gravity required by the laws of endosmosis to act in a state of health, water may be added to the milk. But the *viscidity of cholera blood* would assuredly indicate an increase in the specific gravity, and no dilution would be *necessary* in this disease; but if it were adulterated with water only, it would be a matter of no great importance.

It seems highly probable that milk, or milk and water, would be a much more successful fluid for this purpose than water only, and would certainly offer many great advantages, especially if the injection were to be made directly into the venous system, as the corpuscles of the blood do not suffer any material alteration in form, when examined microscopically, after dilution with milk; *they suffer nothing from the admixture*, especially if the milk is obtained from an animal of the same kind as the blood experimented on, *and if the milk used be pure* and unmixed with water.

I apprehend also that the introduction of an albuminous constituent is essentially necessary, to supply the waste of this vital pabulum experienced during the exhaustive dicharges of this disease.

It is quite a question whether the subsequent symptoms and fever, exhibited during the recovery from collapse, do not depend as much upon the loss of the albumen and salts of the serum, as upon the great difference subsequently existing in the relation between the quantity of the *solids and watery fluid* of the blood.

The chemical constitution of milk does not differ very materially from that of the chyle obtained by healthy digestion, which would of course be the only means *nature* would employ to regenerate slowly the lost liquor sanguinis.

Art physiologically directed comes to aid of nature, and, by employing her own Divine laws, assists her early efforts and wonderfully aids the cure—*gains time*, an element of vital importance in this marvellously rapid and fatal disease.

Nature would then merely have to regenerate the lost epithelial cells, which would of course be a work of time; and no efforts of art could remedy this defect; if the amount of the epithelial exfoliation had been very excessive, the exhaustive discharges of the choleraic diarrhœa would go in spite of all our injections; for the intestinal mucous membrane would then be in the condition of the dermis denuded of its epidermis by artificial vesication; exosmosis must occur by serous transudation until the protective covering had been reformed, when endosmosis would again recommence from the re-establishment of the physiological action of these wonderful cells.

Hoping that some members of the Association may have the opportunity to put these suggestions in practice, and be able to communicate the results through the *Journal* to the profession.

I am, etc., W. B. Herapath.

Bristol, August 1854.

This letter, coming from so distinguished a chemist, gratified me very much; and from it I gather that the use of milk in transfusion, and as a substitute for blood, is novel, and whatever little credit, therefore, is due to so humble a suggestion, must be awarded to Toronto, where its use was not only suggested, but actually put into practice.

The fact that milk (provided it has not parted with life) may be injected into the human system by the veins is now established; and it remains to be seen how far it may be useful as a remedial agent, not only in cholera, but as a restorative in cases of Uterine Hœmorrhage, or Hœmorrhage from loss by wounds. In the cases in which it has yet been tried, all other means were exhausted before the attempt was made to inject the milk; and I am informed, both by Dr. Daniels and Mr. McKenzie, that after my attendance on the cholera patients ceased, in no case was transfusion attempted, until every one present concluded that the patient was actually dying. I regret exceedingly that my own serious illness should have prevented my continuing to visit the patients, as I was thus prevented carrying out the observations; enough, however, was witnessed to show, that, while we may expect much good from transfusion, it cannot be expected to restore to health the body in which serious local disorganisation has taken place: the earlier the collapse, and the sooner the milk be used, the better.

Dr. Owen Rees, in a very late publication, thus expresses himself:—"With regard to the chemical constitution of the fluid, it would appear that we can scarcely venture to interfere with the organic constituents of the blood, nor imitate the animal extractions and protein compounds of the circulating fluid, in order to supply them if deficient. There is, however, no occasion for this in Asiatic cholera, for the evacuations from the intestinal surface which destroy the healthy character of the blood in that disease, appear to contain but little organic matter, being chiefly made up of water, holding the salts of the blood in solution. Thus Vogel and Wittstock agree in describing cholera evacuations as containing intestinal mucous, traces of albumen, and the ordinary salts of the blood with carbonate of soda somewhat in excess. The analysis of cholera blood again points clearly to the necessity of supplying more especially salts and water, if we desire to restore it to the healthy standard." Now, if we take a review of the composition and properties of milk, it will be found to possess all the qualities above desired by Dr. Rees. Thus the distinguished chemist Simon remarks, "that perfectly fresh milk has always a decidedly alkaline re-action, and it retains this property for a longer or shorter time: the milk of woman retains its alkaline re-action longer than that of cows, and the milk of healthy women longer than that of invalids."

On examining the milk under the microscope, we perceive a great number of fat vesicles of very different sizes swimming in a clear fluid, and occasionally epithelium cells. From repeated comparisons I have found that the fat vesicles in the milk of women are generally larger than those in the milk of cows In addition to these, we observe, under certain circumstances, other microscopic objects. The fat vesicles have, as Raspail declared, a solid envelope, a point which has been confirmed beyond dispute by Henle. Raspail considers that it is composed of coagulated albumen; it is, however, more than probable that it consists of caseine. Henle has shown that this capsule may be dissolved by acetic acid, and that butter then issues from it. It is probable, however, that this fluid fat becomes enclosed in a new envelope, for Ascherson has observed that a membrane immediately forms around every drop of fat that is brought in contact with a solution of albumen; and have found, says M. Simon, that fat shaken with a caseous substance (crystalline) in a state of solution, causes a partial coagulation by the formation of such membranes or capsules.

"When milk is left to itself," continues Simon, "for a considerable time, it coagulates, in consequence of the conversion of a portion of its sugar into lactic acid. This change often takes place *very rapidly in cow's milk*, and generally more quickly than in woman's milk." By reference to the analysis, it will be seen that in every particular cow's milk alive, and therefore fresh, possesses every necessary quality, as already observed; there is fuel for the sustentation of animal heat, and salts to supply the place of those drained away, mixed not by any cunningly contrived art of man, but in vital combination with a living fluid; for I think that we ought not to lose sight of the fact that, when we speak even of the water of blood, that we speak of water in a particular state, for it certainly must possess properties differing from the ordinary properties of water, and so on with every other constituent of the blood.

COW'S MILK.

Water	857·0		861·0	823·0		
Solid constituents	148·0		139·0	177·0		
Butter	40·0		38·0	55·0		
Cassia	72·0		68·0	67·0		F. Simon.
Sugar and Extractine Matter	28·0		29·0	51·0		
Fixed Salts	6·2		6·1	13·0		
Earthy Salts						
Phosphate of Lime	2·31	47·1		3·44	50·7	
Phosphate of Magnesia	0·42	8·6		0·64	9·5	
Phosphate Peroxide Iron	0·07	1.4		0 07	1·0	
Chloride of Potassium	1·44	29.4		1.83	27·1	
Chloride of Sodium	0·24	4·9		0.34	5·0	
Soda	0·42	8.6		0.45	6·7	

PROXIMATE CONSTITUENTS OF THE BLOOD.

Protein Compounds:—Fibrin, Albumen, Globulin,

Colouring Matters:—Hœmatin, Hœmaphein.

Extractive Matters:—Alcohol extract, Spirit extract, Water extract.

Fats:—Cholesterin, Serolin, red and white solid fat, containing Phosphorus, Margaric acid, Oleic acid.

Salts:—Iron. Albuminate of Soda. Phosphates of Lime, Magnesia and Soda. Sulphate of Potash. Carbonate of Lime, Magnesia and Soda. Chlorides of Sodium and Potassium. Lactate of Soda. Oleate and Manganate of Soda.

Gases:—Oxygen. Nitrogen. Carbonic. Sulphur, &c. Phosphorus.

DR. REES' ANALYSIS OF CHYLE.

Water	902·37
Solid constituents	97·63
Fibrin	3·70
Fat	36·01
Albumen	35·16

Extractive matters soluble in alcohol and water 3·32
Do. do. in water only 12·33
Salts as in lymph .... 7·11
Salts—chloride sodium.
Lime—sulphate and phosphate.
Other soluble salts—peroxide of iron.
Earthy salts.

CASE 1ST.

Thomas Harrison, aged 40, a native of Ireland, a farmer, resident near Brockville, admitted into tho Cholera Sheds, General Hospital, July 10th, 1854, states that he was quite well when he left his home, and for some time after leaving the steamer; indeed, until the evening of July 9th, when he was seized, about 10 o'clock, with nausca, accompanied almost immediately with tendency to fainting and diarrhœa. He continued ill throughout the night, and received no benefit from the medicines which were then administered. Finding that he was seriously ill, he was brought to the Hospital. On his arrival, 10 o'clock a.m., he was placed in bed, covered with warm blankets, and was given hydrg. submur. gr. x. dry on the tongue, merely washing it down with a little iced water. His countenance was pale and cadaverous, sunken and cold, particularly the alæ of nose, the tongue was contracted, pointed, and cold as ice; fingers shrivelled, cold, and pointed; vomiting of liquid, having all the characters of similar fluid passed constantly and freely from bowels; cramps in bowels very severe, less so in legs; pulse small, contracted, 120; breath cold; gave calomel every 20 minutes; at 11 o'clock, vomiting continuing, he got—

℞. Argenti: nitr: gr. j.
Aq. distill. oz. j, ft. haust.
To be taken every half hour.

At 1 o'clock p.m.—Finding that there was no improvement, but, on the contrary, that the symptoms had not yielded, I proposed to my friend and colleague, Dr. Hodder, to follow out a plan of treatment which had already been discussed between us, namely, that we should transfuse warm fresh milk into the veins. Dr. Hodder coinciding in my opinion, and satisfied with the physiological data on which that opinion was based, readily assented to the operation. Previous, however, to undertaking one of so serious a nature, as we then deemed it to be, I sought the advice of some other medical friends, among the number, Dr. Widmer, who, by message, as I could not see him, requested us to be very cautious as to what we did, least, in case of immediate death, the public mind should become excited. One of my colleagues, also, could not bring his mind to approve of the step. We determined, therefore, to delay the operation until there could scarcely be a doubt that death was imminent. At about 3 o'clock the prostration had greatly increased; the man lay on his back, with his eyes sunken, countenance of ashy hue, hands cold, tongue equally so, breath drawn, in gasping sighs, and the pulse gone from the wrist. We now, therefore, commenced the operation. Dr. Hodder kindly undertook to introduce the tube and to inject, whilst I superintended the procuration of the milk. An ordinary glazed earthenware bowl was placed in warm water at the temperature of the blood. A cow, which was grazing close at hand, was brought up to the shed, and the nurse, with great care, keeping the teat close against the side of the vessel, to prevent frothing, drew off the milk in sufficient quantity; the syringe—a brass, anatomical injecting 4 oz. syringe, made by Neeves of London—having been warmed, was now filled with the fresh living milk. Dr. Hodder with considerable care introduced it into the tube previously inserted, and tied in the median vein; by a slow, steady motion the fluid was pressed on, while a gentleman present kept his finger on the pulse; in a few seconds the pulse was distinctly felt, first weakly, then more perceptibly, until at last he exclaimed, "How the pulse rises!" almost simultaneously the eyes responded, the half-closed lids being raised, the lustreless orbs giving utterance to the relief which was being given, while deep and well-drawn inspirations told how readily the lungs responded to the vital tide which now flowed towards them. Three syringes full having been passed into the system, the following effects were noticed—repeated sighing the breath being drawn deeply and fully, with evident sensations of relief; the pulse quite perceptible and steady, 100 in the minute; the voice, which was unearthly before, was clear, though not strong; and whereas, before the operation he was perfectly careless and, indeed, reckless as to his personal safety and the care of his family, almost his earliest thoughts were directed to the welfare of his children and wife. The arm being bound up, Harrison, with much strength, turned himself on his side, and desired to sleep. Knowing that, under the condition to which he had been reduced, it was not at all probable that he would be enabled to keep up the animal heat of his body, care was taken, by artificial means, to attain this desirable end; while, therefore, hot bottles were placed against his feet, his chest, body, arms, and spine were ordered to be rubbed with hot turpentine, and hot flannels were to be kept constantly over his body; and as nutriment he was supplied with small quantities of strong beef tea whenever he would take it, with white of egg and brandy and water, an oz. of brandy, to white of two eggs.

At 8 o'clock p.m.—Had some good natural sleep; no vomiting, bowels not moved once, no cramps; surface requires to be kept artificially warm; if the applications are discontinued becomes cold; expresses himself greatly relieved, but still feels very weak, has by no means so great thirst as before, kidneys have acted. Treatment continued.

July 11th.—Has had a tolerable night, bowels moved twice, discharges coloured with bilious matter, passed water, has vomited this morning a free quantity of bile; pulse quite perceptible, 100, and easily compressed; no cramps or pain in limbs. My friend, Dr. Clarke, whose valuable services at the General Hospital are too well known to require any commendation from myself, suggested the desirableness of administering a gentle laxative, with a view of procuring a freer discharge of matter from the bowels. Accordingly, it was determined to administer at even-time a couple of grains of pil. hydrg., and a tea spoonful of ol. recini, and continue warm applications.

July 12th.—Medicine has acted freely, but not too much so; he has vomited a large quantity of bile; pulse very much improved; is now painfully sensitive to the application of turpentine, which at first only produced an agreeable glow of heat; enjoys his beef-tea, and takes his brandy and egg. He had after this a troublesome bilious diarrhœa, but progressed towards convalescence, and left Hospital convalescent. I learned on Wednesday last, January 23d, that he was yet alive, and in good health. It was noticed that many patients bore white of egg and brandy with cod-liver oil, when the stomach rejected other nutriment.

CASE 2D.

Mary Hall, an Irish woman, married, and the mother of four children, the youngest being an infant at the breast. This patient had come into Toronto with her husband to attend the demonstration made by the Orange Society. She was quite well on leaving home, and remained during the day at a small tavern on Queen Street; in the afternoon she was seized with distinct symptoms of cholera. At 10 o'clock p.m., I saw her for the first time. In order to procure for her efficient attendance, she was with some difficulty persuaded to enter the Hospital Sheds. On her arrival she was placed in a comfortable warm bed, and was ordered

Argenti. nitrat. gr. j.
Aq. distill. oz. j, ft. haust.
Every half hour. To have beef-tea, and brandy and egg.

July 13th.—She has passed a restless night, and although the vomiting was considerably lessened, yet the discharge of rice-water evacuations from the bowels continued; her pulse was extremely feeble and quick; countenance pinched and of ghastly hue; tongue cold and pointed; tossing about her arms, and sighing; careless about her fate, and is not roused by any reference to her children or husband. Dr. Hodder, equally interested with myself in the history of the disease, and anxious to do all in his power to mitigate its horrors, came to the sheds, and witnessing the condition of the poor woman, at once agreed to perform transfusion. The same precautions were adopted in this case, as were found necessary in that of Harrison, and with like results. At the time the tube was put into the vein she was pulseless, and although she could be roused, yet was incapable of answering questions, and altogether she presented a hopeless appearance. Two syringes full, equal to 8 oz., of the fresh warm milk from the same cow which afforded the supply to Harrison, were injected into the vein. As soon as the operation was completed, she expressed the greatest relief, and seemed irresistibly impelled to draw deep and frequent inspirations. The arm being bound up, as with Harrison, so with this patient—a desire to sleep was manifested, and turning over on her side, she composed herself to slumber. Hot bottles were kept not only to her feet but about her body, and she was rubbed with hot turpentine, and then swathed in warmed flannels. At evening visit she was evidently improved, had some sleep, the renal secretion was restored; her pulse was steady and quite perceptible; countenance relieved, and not so pale and ashy; no vomiting, nor discharge from bowels.

Ordered to have beef-tea, and brandy and egg.

July 14th.—Improving, although very weak; has had occasional vomiting of bile, and has had several bilious evacuations. She was carefully watched, allowed to have nothing but beef-tea and brandy and egg occasionally, and was finally discharged convalesing on the 17th July.

Two other cases were transfused by myself, both immediately after being brought into hospital, and when *in articulo mortis;* the one a man named James Pickles, and the other a female. In the last case it was quite evident that life was ebbing fast; and to complicate her difficulties, the veins were so empty and small, that I was for some time foiled in my endeavours to find one; after some difficulty, I succeeded in getting a pipe into the vein of the arm, and injected two syringes full, equal to 8 oz; the effect was to recall the pulse at the wrist, to enliven the countenance, and restore strength and fulness to the voice From the lateness of the period at which the operation was performed, and from the disease having nearly done its work ere she was brought into Hospital, her rally was only temporary; for four or five hours she gave promise of amendment, and seemed greatly relieved; but afterwards she again began to sink, without, however, any renewal of the diarrhœa or vomiting, and finally died on the following morning. In reference to this case, I think it right to state that I intended to transfuse a second time, but, being seized with alarming illness, neither in it nor in any case was the operation repeated.

The next cases are kindly furnished me by one of our most industrious medical pupils, Mr. John Mackenzie, whose devotion to the sick during the whole of the cholera visitation was truly praiseworthy, and deserved to be honourably rewarded by the Board of Health. When others refused to lay hands on the dead, this gentleman removed them without any hesitation, to make room for the living.

TRANSFUSED.

1.—*Wm. Fraser*, admitted July 16th, was a very athletic young man, in the employ of Mr. Tuminey, was a carpenter by trade, formerly lived in country, had had Diarrhœa for several days, on Saturday, 15th inst., eat a great many cherries; on Sunday morning early, or on Saturday night, he was taken with violent vomiting and purging; on admission he had violent vomiting of Rice water, together with cramps. Nitrate of silver was tried, together with calomel, brandy and water, beef tea, &c.

On Monday, 17th, pulse scarcely to be felt, cramps less frequent, but vomiting continues; evidently sinking fast; at 10 A.M., median basilic opened, and tube introduced without difficulty; about 10 oz. of milk thrown up. Pulse in 10 minutes could be felt, and voice, which before was scarcely audible, could now be heard; the patient expressed himself far stronger; and though he was greatly revived by transfusion, yet vomiting continued in spite of everything, and he died at about 2 P.M.

2.—*James Conway*, admitted July 12th, an able-bodied labourer, brought to hospital in state of collapse; pulse scarcely perceptible, eyes sunken; mouth open, with that peculiar dropping of jaw; tongue cold as ice. Saw him a few minutes after he was laid on bed. I then thought the man would die before the tube could be introduced, and as his wifo was piteously imploring something to be done, I determined to attempt it alone. Introduced the tube, aud transfused about 8 oz. milk. Went and got brandy, and made his wife give it to him, and though he remained insensible during the time I was introducing tube, yet he so far recovered as to be able to speak to his wife, but died about 1 P.M.

This man had no vomiting latterly, though his wife stated he had vomited during night. Was taken during previous night.

3.—Dutch woman, admitted July 18th, unable to speak English, came in state of collapse; pulse absent, tongue cold; eyes sunken, the fingers wrinkled, and nails blue, having the appearance as if wrinkled by cold,—evidently dying. Brandy and water was given. Transfused about 11 P. M., rallied a little, but died in afternoon, about 2 P. M.

Such is the brief account of the cholera cases which I have the honor to submit to the Institute. In conclusion, I would venture to express a hope that the Corporation of the city will not again permit themselves to be taken by surprise, as we unquestionably were last summer. The pestilence came on us suddenly, and cases poured into the sheds ere the fitting accommodation could be provided. In this way, wards became overcrowded; the sick had neither utensils nor proper bedding, nor food for their accommodation; and much distress arose. By enlarging the Board of Health, and placing it on a better footing, much good would result. Why not empower the Members of the Corporation for each ward to associate with themselves a medical man, resident in their own or in the nearest ward, to act as a health committee. In May let these committees commence their work, visiting first the worst streets, and ordering the removal of all nuisances and filth; and, in case of disease, looking after the sick in their districts. There are many old decaying wooden houses in our lanes and bye-streets, which are not even good enough for kennels; surely the owners of such places ought to be compelled to remove them, or, at all events, to cleanse and drain their premises. It is well known that cholera delights in filth and moisture. No allusion is made to the important question of water supply, as the proper authorities have taken up the matter; it may, therefore, be hoped that the detestable liquid quaffed last year, and even at this time, will not be much longer supplied to us. Money ought not to be the sole object when the health of a whole city is concerned, and the guardians of the public health ought to be entrusted with full powers to act for the good of those places under their care.

I trust that these few remarks, uttered in no captious spirit, but from an earnest desire to prevent a recurrence of perhaps scenes then unavoidable, will not be misconstrued.

Observations on the Colouring Matters of Flowers.

BY E. FILHOL.

WHITE FLOWERS.—If flowers of *Viburnum opulus*, *Philadelphus coronarii*, *Chrysanthemum vulgare*, white roses, and a number of other flowers, be exposed for a few moments to the action of ammonia, they acquire a yellow tinge of greater or less intensity, which remains for a considerable time. Flowers of *Viburnum opulus* by this treatment acquire a yellow colour as fine as that of *Cytisus laburnum*. The matter which thus becomes yellow under the influence of alkalies appears to be present in all white flowers; some flowers contain only a small quantity of it, but these are rare.

In variegated flowers of which the corolla is partially white, these portions usually acquire a fine yellow tint under the influence of ammonia. The stamina, the pistils, and in general all the white parts of flowers, act in the same manner. The leaves themselves become yellow when they are accidently deprived of chlorophylle. I ascertained this fact with a plant of *Convallaria polygonatum*, of which the leaves presented alternate green and white bands. The latter became bright yellow from the action of ammonia, exactly like flowers. The tissue of some fruits also becomes yellow, although less distinctly, under the influence of alkalies.

The most convenient mode of converting a white flower into a yellow one is to introduce it into a wide-mouthed flask containing a little liquid ammonia, and to expose it to the action of the alkaline vapour. The change then takes place very rapidly. When the greatest part of the flower has become yellow, it may be taken out of the flask and exposed to the air, when the parts which still remained white will gradually change until the flower acquires a uniform tint. The flower may also be dipped into water, alcohol or æther, mixed with a little ammonia. The latter fluids should be preferred when the flower is covered with a fatty coating, which would prevent their being moistened by a watery fluid. If a white flower that has been rendered yellow be dipped into acidulated water, it gradually recovers its white colour.

These experiments remined one that when dyers wish to employ the colour of woad in dyeing, they add a little carbonate of soda to their vat, which gives considerable brightness to the tint. It is easy to prove also that acids, even when very weak, cause the disappearance of the greater part of the colour of a decoction of woad. From this it seems not improbablo that the substance which communicates to white

flowers the property of becoming yellow when in contact with alkalies may be *luteoline.*

If the petals of white roses be boiled with distilled water, and a little carbonate of soda and sulphate of copper be added to the decoction, as is done with the decoction of woad, a liquid is obtained possessing a bright golden-yellow colour which may be employed in dyeing yellow. This liquid will give a fine yellow tint to linen and cotton fabrics, and nearly all white flowers will furnish similar results. I have dyed pieces of linen and cotton with decoctions of white roses, of the flowers of *Spiræa filipendula*, *Philadelphus coronaria* and *Galium Mollugo.*

The matter to which white flowers are indebted for this property of acquiring a yellow colour under the influence of alkalies, dissolves readily in water, still more so in alcohol, but less in æther. When the superficial layer of the petals of flowers which have been coloured yellow by ammonia is removed, all the cells are seen to be filled with a yellow fluid, in which no granules are to be perceived.

Dark Red Flowers.—With boiling water or alcohol, the flowers of the wild poppy furnish a violet-red solution. This acquires a fine scarlet colour by the action of acids, even when very weak. If ammonia be poured into the liquid thus acidulated, it becomes of a fine violet colour, without the least mixture of green. But if, instead of adding ammonia to the acidulated liquid, it is added directly to the infusion, this acquires a dirty greenish-red tint. When the flowers themselves are exposed to the action of ammonia, they acquire a fine violet color, like that obtained with the acidulated fluid. The colouring matter of the poppy therefore differs greatly from the cyanine of M.M. Fremy and Cloez, for alkalies do not give it a green colour.

The flowers of *Pelargonium zonale* also become of a fine violet colour under the influence of ammonia; their colouring matter behaves like that of the poppy. The dark red garden verbena gives a violet-red tint to alcohol. The alcoholic solution, treated with ammonia, acquires a vinous colour with a slight greenish tint. If the alcoholic infusion of these flowers be digested with a little dry powdered hydrate of alumina, the latter acquires a light yellow colour, and the supernatant fluid becomes of a fine red colour under the influence of acids, and of a blue without the least mixture of green by the action of bases. The verbena consequently contains two distinct matters, of which one becomes blue under the influence of bases, whilst the other becomes yellow; it is to the mixture of these two matters that the green colour of the alcoholic tincture of these flowers is due.

The petals of *Anemone hortensis* act like those of the verbena. The flowers of the red pæony become of a pure blue colour under the influence of ammonia. These flowers are rapidly deprived of colour by alcohol; the tincture which they furnish is but slightly coloured, but it becomes of a deep and bright red by the addition of the smallest trace of acid. The acidulated liquid becomes blue with ammonia, whilst the non-acidulated alcoholic solution acquires a greenish tint. The petals of dark red roses become blue when exposed to ammoniacal vapours, but the colour soon passes to a greenish-blue. Alcohol readily dissolves the colouring matter of roses, but acquires very little colour. The slightest addition of acid communicates a deep red color to the alcoholic solution; ammonia poured into the acidulated liquid changes it to a greenish blue.

Rose-coloured Flowers.—These flowers contain a mixture of two juices, of which one is colourless in acid liquids, whilst the other is red. The former becomes yellow when mixed with alkalies, the second becomes blue, and the mixture of these latter colours produces a green tint. Hence the tints which will be acquired by red or rose-coloured flowers, when exposed to the action of ammoniacal vapours, may be easily indicated beforehand. It is clear that the green colour will approach yellow more and more in proportion to the paleness of the rose, and that it will have a blue tendency in proportion as the colour becomes deeper.

Blue Flowers.—The preceding statements regarding red and rose-coloured flowers applies also to blue flowers. The green colour produced in blue flowers by the action of watery ammonia tends more and more to yellow in proportion to the paleness of the flower.

Effects of the Mixture of the white and colored juices of Flowers.—When flowers of iris, of violets, pæonies, of *Cercis siliquastrum*, &c., are infused in alcohol, one is struck with the weakness of tint of the alcoholic solution, even when the petals are completely deprived of colour. It appears natural, at first sight, to attribute this decoloration to the influence of the alcohol, which may act as a reducing agent; but a close examination of the facts does not permit us to rest satisfied with this explanation; and without denying that alcohol may exercise the influence attributed to it by M. M. Fremy and Cloez, I think that the following theory, either alone or combined with that just referred to, may readily account for the circumstances in question. In fact, if, instead of treating the above-mentioned flowers with alcohol, they are infused in boiling water, the watery solution is not more deeply coloured than the alcoholic tincture. It would be necessary therefore to admit that water itself is a reducing agent, which is by no means probable.

If into these solutions, whether watery or alcoholic, the smallest quantity of a soluble acid be poured, they instantly acquire a bright red colour, far deeper in tint than the original liquid. The kind of acid is quite immaterial, for even sulphurous acid immediately brightens the shade, and reproduces the colour which was only concealed. The prolonged action of this acid however soon destroys the colour. Can it be imagined that the colouring matter would reappear immediately upon the addition of *any* acid, if it had been reduced? and especially on this hypothesis, can we account for the action of sulphurous acid? I think not.

In my opinion, the decoloration is due to the mixture of the juice contained in the colourless cells with that of the coloured cells. When alcohol or boiling water acts upon a flower, its organization is destroyed, the juices contained in its cells become mixed, and the colouring matter disappears. The following experiment lends support to this explanation.

If two equal volumes of a slightly acidulated infusion, either watery or alcoholic, of pæony flowers be diluted, the one with four times its volume of water, the other with four times its volume of an infusion of white flowers, it will be seen that the latter will retain much less color than the former.

The white juices consequently destroy, or rather dissemble the colouring matter. The question now arises whether these juices act as reducing bodies, or whether they simply form colorless combinations. The experiments to which I have referred above may, I think, serve to answer this question; for if reduction takes place, sulphurous acid would not reproduce the colour. I consider therefore that the colouring matter does not experience any reduction, and that it forms with the elements of the colourless juices or a colourless combination. In infusions prepared by the action of alcohol or water upon flowers, one portion of the colouring matter remains free, whilst the other enters into the combination just mentioned. It is easy to separate the coloured portion from the colourless, by triturating the liquid with a little artificial phosphate of lime or dry hydrate of alumina; the coloured part is the first to fix upon the solid body, whilst that of which the colour is dissembled remains for the most part dissolved. If the liquid be filtered, it passes without colour. It may then be colored red by acid, and green or blue by an alkaline solution.—*Comptes Rendus*, July 24, 1854, p. 194.

On the Discovery of Microscopic Shells in the Lower Silurian Rocks.*

BY PROF. EHRENBERG.

(*Communicated by Mr. Leonard Horner.*)

The minute grains of greensand, which are characteristic of many rocks, have a different nature from the green earth often met with in concretionary masses. The former, from the *glauconie* of the Paris *calcaire grossier* to the azoic green sand, near Petersburgh, appears to consist of green opalescent casts of Polythalamia, composed of a hydro-silicate of iron. The cretaceous greensands of England contain unmistakeably, these stony casts. In the *calcaire grossier* and nummulite limestones occur beautifully preserved and perfect examples of Quinqueloculina, Rotalia, Textularia, Grammostoma and Alveolina. In the Lower Silurian greensand casts of detached cells of Textularia and Nodosaria were found. Prof. Forbes said, that Mr. Sorby had discovered Foraminifera in the Aymestry limestone; but as some of the beds with green grains were of freshwater origin, it was almost impossible that all greensand should be derived from this source. Prof. Sedgwick pointed out instances in which the green colour was due to particles of chlorite.—Sir R. I. Murchison stated, that the whole group of Lower Silurian strata existed near Petersburgh, though only 1,000 feet thick: the upper part, representing the Bala limestone,

* British Association.

was 50 to 80 feet thick; next came a sandy bed, with green grains; then brown sandstone, with oboli; and lowest of all, shale, with green grains and crustaceans, once supposed to be fishes, in which it appeared that Prof. Ehrenberg had discovered these Foraminifera.—Mr. A. Bryson said, he had sometimes obtained the silicious shields of Diatomaceæ from boulder clay by means of a fine sieve, when other means had failed, because the objects adhered to the minute particles of mica.

CANADIAN INSTITUTE—SESSION 1854-55.

Seventh Ordinary Meeting—Saturday, February 3d, 1855.

The names of the following candidates for membership were read:—

John Helliwell .... Toronto.
Edward Berry.. Quebec.
Henry May .... Quebec.

The following gentlemen were elected members:—

Robert Bell .... Carleton Place.
Robert Grier.. Toronto.

A paper, communicated by Major Lachlan of Montreal, was read by the Corresponding Secretary, being "An Account of an extraordinary sudden fall in the waters of the Niagara River in March, 1848, caused by a temporary obstruction of the outlet of Lake Erie by the ice."

Professor Hind illustrated the method of manufacturing gun cotton.

Eighth Ordinary Meeting—February 10th, 1855.

The names of the following candidates for membership were read:—

A. N. Buell.. Toronto.
W. Thompson .... Toronto.

The following gentlemen were elected members:—

John Helliwell.. Toronto.
Edward Berry.. Quebec.
Henry May .... Quebec.

Thomas Henning read a paper "On the Asteroids."

James Bovell, M.D., communicated "Some observations on microscopic preparations of Chalk from Barbadoes, containing some infusoria."

Ninth Ordinary Meeting—February 17th, 1855.

The names of the following candidates for membership were read:—

C. J. Campbell.. Toronto.
Alex. M'Donald.. "
Edward Shortis.. "
J. C. Clarke .... Port Hope.
Thomas Galt .... Toronto.
Dr. Carter.. Nelson.
William Morris .... Perth.
Alex. Morris.. Montreal.
James Wilson, M.D.. Perth.

The following gentlemen were elected members:—

A. N. Buell .... Toronto.
W. Thompson .... "

The following donations were announced:—

From the Hon. J. M. Brodhead of Washington, by A. H. Armour, Toronto—

Compendium of the United States' Census, 1850.
Penal Codes in Europe, by H. S. Sandford.
Cruise of the Dolphin, by Lieut. Lee.
Exploration of the Red River of Louisiana, by Lieut. Marcy.
Mexican Claims; Report of the Select Committee.
Exploration of the Valley of the Amazon, by Lieut. Gibbon.
Sickness and Mortality on Emigrant Ships.
Maps to accompany Lieut. Lee's Report.
Do. do. do. Marcy's do.
Do. do. do. Gibbon's do.

From A. H. Armour, Toronto:—

Railroad to the Pacific, Northern Route; its general character, relative merits, &c. By Edwin F. Johnson, C.E. With Maps and sections.

From the Hon. East India Company:—

Meteorological Observations at the Hon. East India Company's Magnetic Observatory at Madras, in the years 1846-50.

The thanks of the Institute were ordered to be presented to the Hon. Mr. Brodhead, Mr. Armour, and the Hon. East India Company.

Professor D. Wilson, LL.D., read a paper "On some physical elements of Ethnological classification, and their bearing on the question of the unity of the human race."

Tenth Ordinary Meeting—February 24th, 1855.

The names of the following candidates for membership were read:—

D. L. Macpherson .... Toronto.
Patrick Macgregor .... "
Alexander Grant .... "
Alexander Logie.. Hamilton.
James Dundar Pringle .... "
T. S. Hunt.. Montreal.

The following gentlemen were elected members:—

C. J. Campbell.. Toronto.
Alex. M'Donald.. "
Edward Shortis.. "
J. C. Clarke .... Port Hope.
Thomas Galt.. Toronto.
Dr. Carter.. Nelson.
William Morris.. Perth.
Alex. Morris .... Montreal.
James Wilson, M.D.. Perth.

The following donations were announced:—

From E. C. Hancock, Toronto—

Britannia Depicta, or Ogilby Improved, by John Owen.

From the Hon. J. H. Brodhead, Washington:—

The Case of the Black Warrior, 1854.

Report of an Expedition down the Zuni and Colerado Rivers, by Capt. Sitgreaves, C.T.E.

From A. H. Armour, Toronto:—

Montreal and the Ottawa, by T. C. Keefer.

The thanks of the Institute were ordered to be transmitted to the above-named gentlemen.

Professor Hind read a paper "On the North American drift."

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY AND STATED MEETING.

WEDNESDAY, 3rd JANUARY, 1855.

Lieut. T. C. Malony, R. A., and T. B. Harvey Esq., were proposed as associate Members.

ANNUAL GENERAL MEETING.

WEDNESDAY, 10TH JANUARY, 1855.

Report of the Council of the Literary and Historical Society of Quebec, for 1854.

The Council of the Literary and Historical Society respectfully submit, in accordance with the usual practice, a Report of the Proceedings of the Society during the year which has just closed. That year has been marked by events of more than ordinary interest and importance to the Society. We have on the one hand, serious losses and misfortunes to deplore, while on the other, we are consoled by the progress which, in spite of every obstacle and trial, the Society has made during the last twelve months.

Our last annual meeting was held, as you remember, in the Rooms which the Society had, for many years, been allowed to occupy in the old Parliament buildings. Within little more than a fortnight from the day of that meeting, the whole of those buildings were destroyed by fire. In that calamitous fire, the Society sustained a severe loss. Nearly the whole of its well selected and very extensive Museum of natural history and mineralogy, the fruits of the labor and expenditure of many years, embracing a unique collection of American birds, and specimens of almost all the natural productions of the country. as well as many antiquarian objects of interest, perished in the flames. Through the praiseworthy exertions of some of the members of the Society, a large portion of our Literary, and almost the whole of our valuable manuscripts relating to the early history of the country, were rescued from destruction. But a serious inroad was, notwithstanding, made upon our library shelves, and many valuable sets of books have been rendered comparatively useless by the loss of one or more volumes from among them. The pecuniary loss which the Society sustained on that occasion has been estimated at about £1400, but many of the most interesting objects which were destroyed in the Museum are such as cannot be replaced.

Under these circumstances immediate steps were taken by the Council to meet the emergency, and to repair as far as possible the severe losses of the Society. In the first place rooms were secured, fitted up and furnished for the Society's meetings, and for the temporary reception of the remains of the Library, and the wreck of the Museum, and an appeal was made to other Institutions of a similar nature with our own for contributions to enable us to commence the re-construction of our Museum.

The first meeting of the Society was held in our present rooms, on the 8th March. When it is borne in mind that the Council, had to provide, fit up and furnish the rooms, it will, we think, be admitted that no time was lost in providing the Society with the necessary accommodation. The fitting up and furnishing of the Society's rooms involved an outlay of a considerable sum, as compared with the resources of the Society, but the Council did not hesitate to assume the responsibility of incurring it; and notwithstanding the expenses thus entailed, and other extraordinary drains upon our finances, we have been almost enabled, from the increase of the number of our members during the year, to meet our expenditure from our ordinary resources.

It is with great pleasure we record that during the past year the Society has published two numbers of its Transactions. One of these is composed wholly of communications read before the Society many years back, the publication of which, after they had been placed in the printer's hand, had, for various reasons, been delayed. The other is made up of communications read before the Society during the last twelve or fifteen months.

A list of all the Papers read during the course of the past year is subjoined. The papers are principally upon subjects of a local and practical character. It is satisfactory to be able to add that, with scarcely an exception, an interesting paper, sometimes more than one, was read at each of the literary meetings. Those that have been selected for publication will be found to contain much valuable information. The Meteorological Observations alone will form a most important addition to the mass of information which is being collected, both in Europe and America, on the subject; more especially as the locality of Quebec appears to be peculiarly favourable for the examination of some of the most interesting Meteorological phenomena.

In connection with this matter, it may be mentioned that the Society has long been anxious to secure a building for its own use, where its Museum and Library might be deposited in safety, and in such a way as to be available, as heretofore, to the public generally, and in which we may be able eventually to establish an Astronomical and Meteorological Observatory in connection with and under the auspices of the Society.

In order to carry out these objects, the Council applied to the head of the Government for a grant of a portion of the Ordnance property on the north side of the Government Gardens in this city, sufficiently large for such a building as they thought necessary. We regret to say, that this application, although favourably received by the head of the Government here, has been refused by the Ordnance Department at home; the reason assigned that the ground may be required for military purposes, in the event of the Head Quarters of the Military Government of the Province being transferred to this city.

It is much to be regretted, for many reasons, that the prospect of being possessed of a building of our own is not likely soon to be realized; yet we hope that our successors in office will not be discouraged by the failure of our efforts in that respect—but that they will endeavour to devise some expedient for securing for the Society a local habitation, in the enjoyment of which they cannot be disturbed.

We have now to call the attention of the Society to an important step which has been taken by the Council since the commencement of the present Literary Session, with a view to bring the Society more prominently than heretofore before the public. We allude to the publication of the Monthly Proceedings of the Society in the columns of the *Canadian Journal* of Toronto. It had long been felt to be most desirable to publish regularly the ordinary proceedings of the Society at its general and stated, or literary meetings. The publication of the *Canadian Journal*, under the auspices of that young, but rapidly growing and most useful sister Society, the "Canadian Institute," of Toronto, seemed to the Council to present a most suitable medium for the publication of their proceedings. Upon being applied to for that purpose, the Council of the Institute expressed, in the most liberal manner, their desire to meet the wishes of the Society, and offered to allow an account of our Proceedings to appear gratuitously in the columns of their Journal. Since the commencement of the present Session our proceedings have accordingly been published in that Journal, the first publication being prefaced by a short sketch of the history and objects of the Society, furnished by the Council to the Editor at the request of the latter. The Council trust that their successors will see the expediency of keeping up the system of publishing our proceedings on the terms in every way advantageous to the Society.

It is gratifying to be able to state that the Legislature has considerably augmented the amount of the annual grant to the Society, having raised it from £50 to £250. It must, however, be observed that as an indemnity for our losses occasioned by fire, this sum is altogether inadequate. We think, however, we should not regard it in that light; and we have little doubt that if the Society continue to act with the energy and zeal which has marked the present Session, and, above all, if we evidence our existence to the outer world by the publication of useful papers, we shall have little difficulty in obtaining an equally liberal, or even a more liberal grant from the Legislature at its next Session.

One of the most satisfactory proofs of the progress which the Society has already made in public estimation, will be found in the number of members who have during the year been added to its lists. We cannot now give the precise number, but we are sure that they form a very considerable portion of the Society; and we believe we may add that among the recent additions will be found some of our most zealous and useful members.

On the whole, it seems to the Council that the review of the events of the past year presents much that is encouraging. It was indeed ushered in with a heavy disaster, but the effects of that disaster have been more than atoned for, by the zeal and energy of the Society; and at the end of the year we find our finances in a flourishing condition, our numbers rapidly augmenting, our Transactions enriched by two parts, our communications increased in number and importance, and

our proceedings, for the first time for many years, published regularly and in such a shape as to bring the Society most favorably before the public.

We think, therefore, we have much reason to congratulate the Society on the manner in which it has struggled through the past year. In truth those trials and reverses should not be regarded as subjects of unmixed regret, for doubtless to them is due, in a great degree, the unusual spirit and energy which has characterized the Society during the last twelve months.

"Duris ut ilex tonsa bipennibus
Nigrœ feraci frondis in Algido,
Per damna, per cœdes, ab ipso
Ducit opes, animumque ferro."

E. A. MEREDITH. L. L. B.
1st Vice President.

Quebec, January 10, 1855.

OFFICERS ELECTED FOR THE YEAR 1855.

President:
E. A. MEREDITH, L.L.B.

Vice-Presidents—G. T. KINGSTON, A. M.; REV. A. W. MOUNTAIN, B. A.; W. D. CAMPBELL; LIEUT. H. G. SAVAGE, R. E.

Recording Secretary—HENRY E. STEELE.

Corresponding Secretary—A. R. ROCHE.

Council Secretary—N. K. BOWEN.

Treasurer—GEO. T. CARY.

Librarian—E. T. FLETCHER.

Curator of Museum—ROBT. H. RUSSELL, M.D.

Curator of Apparatus—LIEUT. E. ASHE, R.N., F.R.A.S.

Lieut T. C. Malony, R.A., and T. B. Harvey, Esq., were elected Associate Members of the Society.

LITERARY AND STATED MEETING.

WEDNESDAY, 18TH JANUARY.

A Paper was read by Lieut. H. G. Savage, R.E., on the History of Quebec from the Earliest times.

HENRY E. STEELE,
Recording Secretary.

Address to the Governor-General.

On Friday, January 19th, the President and Members of the Literary and Historical Society, waited upon His Excellency the Governor General, at Government House Quebec, and presented the following

ADDRESS.

To His Excellency Sir Edmund Walker Head, Baronet, Governor General of British North America, and Captain General and Governor in Chief in and over the Provinces of Canada, Nova-Scotia, New-Brunswick and the Island of Prince Edward, and Vice Admiral of the same, &c.

MAY IT PLEASE YOUR EXCELLENCY,

We the President, Vice Presidents, and Members of the Literary and Historical Society of Quebec, desire respectfully to approach your Excellency to tender our sincere congratulations on your assumption of the Government of this important portion of Her Majesty's dominions.

We cannot but feel that, we, in common with the other inhabitants of this Province, have much reason to rejoice that Her Majesty should have selected for the Government of this Colony, one whose recent administration of the Government of a neighbouring and sister Colony has been marked with such distinguished success.

It is however as a Society separated from the strife of politics and devoted to the peaceful pursuits of History and Literature and to the advancement of the interests of Art and Science in the Province, that we conceive we have peculiar reason to hail your Excellency's elevation to the high position of Governor of British North America.

Your Excellency's well known devotion to and high attainments in the walks of literature and science, afford our Society an earnest that, while labouring to advance the physical interests of this great and growing country you will study equally to develope its moral and intellectual resources.

By the calamitous fire which destroyed the Parliament Buildings in this city, in the month of February last, the Society sustained a heavy blow in the loss of a large portion of its Library and nearly the whole of its extensive and well selected Museum of Natural History and Geology.

The efforts which the society is now making, to re-construct its Museum, and to repair the other losses then sustained, will, we feel assured, meet with your Excellency's sympathy and good wishes.

We venture to express the hope that, following the example of your Excellency's predecessors, since the foundation of the Society under the auspices of the Earl of Dalhousie, you will do the Society the honour of allowing yourself to be named its Patron.

In conclusion we beg to express our best wishes for the health and happiness of your Excellency, Lady Head, and family.

Quebec, January, 1855.

To which His Excellency was pleased to return the following

REPLY.

Mr. President and Gentlemen of the Literary and Historical Society of Quebec.

I esteem it an honour that you ask me to assume the position of Patron of your Society. But that honour is greatly enhanced by the flattering terms in which you address me on the present occasion. You overrate my literary attainments, but you do not overrate my wish to promote in every way the pursuits of literature and science. According to my firm conviction it is of the highest importance that these peaceful studies should hold their rightful place in the progress of a great and growing country. That they should mitigate the constant pressure of material interests, and soften down those harder tendencies which must always more or less characterize the outposts of advancing civilization. All institutions that tend to promote such objects in Canada are of the highest value, and among them your incorporated Society maintains a distinguished place. I thank you much for the congratulations, and your good wishes for the health and happiness of myself and my family.

The Temperature of the Cold Days of February 1855, at St. Martin's, Isle Jesus, Canada East.

(*Communicated by Dr. Smallwood.*)

The Thermometer at 10 p.m. on Saturday, 3rd February, stood 9°·0 Fahrenheit. On the

4th at 6,	a.m.	at	—14°·8	(or below zero).
2,	p.m.	...	—10°·3	do.
10,	p.m.	...	—22°·3	do.
5th at 6,	a.m.	...	—26°·1	do.
2,	p.m.	...	— 5°·5	do.
10,	p.m.	...	—20°·0	do.
6th at 6,	a.m.	...	—32°·6	do.
2,	p.m.	...	—18°·6	do.
10,	p.m.	...	—24°·5	do.
7th at 6,	a.m.	...	—33°·9	do.
2,	p.m.	...	— 6°·2	do.
10,	p.m.	...	—11°·0	do.
8th at 6,	a.m.	...	— 5°·1	do.
2,	p.m.	...	+ 5°·5	(above zero.)

On Charcoal as a Disinfectant.*

By MR. J. G. BARFORD,—*St. Bartholomew's Hospital.*

Dr. Stenhouse lately called attention to his very ingenious ori-nasal respirator, which depends on charcoal for its efficacy, the action of which is given in the *Journal of the Society of Arts*, for February, 1854. The respirator having been noticed in the *Lancet* of November 25, I need only mention it as an instance of the powerful disinfecting power of charcoal, but at once call attention to the plan I have adopted in the application of this agent as a disinfectant, bearing in mind the results of Dr. Stenhouse's experiments, which prove that charcoal not only

* From the *Lancet*, Dec. 16.

absorbs noxious vapours and putrescent odours, but at the same time oxidizes them, or in other words, makes them undergo a slow but sure combustion, which must have its end in the conversion of deleterious gasses into compounds whose physical and chymical properties would admit of an easy separation or removal from their bed of formation, and which on evolution would not be the least deleterous. I therefore, previous to its use, heated the charcoal thoroughly in a covered crucible with a small hole in its lid, to allow any oxidized material which it might contain to escape, taking care not to have the hole sufficiently large to allow the charcoal to undergo combustion; when thoroughly heated it was allowed to cool, so that on exposure to the air it should not oxidize; in this state it was put into shallow vessels, and placed wherever putrescent odours existed, and in a few minutes the whole of the smell disappeared; but in a day or two the charcoal lost its power. I then thoroughly heated it again, with the same precautions as before, and placed it to perform its duties a second time, which it did with as much efficacy as on the first application. Thus, by the repeated cleansing of the charcoal every or every other day, it does not deteriorate, but the same quantity will effectually remove noxious gases for an indefinite period of time.

With Mr. Holden's permission I was enabled to give it a most perfect trial in the dissecting-rooms of St. Bartholomew's Hospital, which at this time of the year must abound in noxious gases and putrescent odours. Thoroughly heating the charcoal, and planting it in shallow vessels about the rooms, it acted so promptly that in ten minutes not the least diffused smell could be detected, So quick and effectual was its action that arrangements are being made for its constant use. It answers just as well as a purifier of water closets, drains, wards of hospitals, and sick rooms. As a purifier of hospital wards, both civil and military, it might be applied with great advantage, saving patients from the unpleasant smells and effluvia of gangrenous sores, and for this purpose a wire gauze construction, containing the charcoal, might made to surround the affected part at some distance from the dressing, thus the patient himself and those in adjacent beds would not be subjected to the influence of the putrescent odours. All these the charcoal would effectually absorb, doubtless with advantage to the patient and neighbors also. Other quantities of charcoal might be placed in shallow vessels about the wards, and purified every morning, as above mentioned. Being at the command of the poor as well as the rich, it admits of universal use; and, though it may be objected to as a purifier of the wards of hospitals and chambers of the sick, under the fallacious notion that it would emit carbonic acid, and also on undergoing its daily cleansing would again give off the absorbed gases, yet this notion can never enter the minds of those who understand its action, seeing that carbonic acid cannot be generated unless the charcoal is heated in free contact with the air. This is prevented by having a covered crucible in which it can be heated to any temperature without undergoing combustion; and the supposition that the absorbed gases are given off again when the charcoal is heated will be removed by the fact that they are all oxidised, and converted into sulphuric, nitric, or carbonic acid, and water, &c., and the heating of the charcoal is for the whole and sole purpose of removing these bodies, which exist in so small a quantity that they could not be the least prejudicial, even if driven off in the centre of an inhabited room; but, of course, they all pass up the chimney. Thus charcoal is more efficacious than any other disinfectant when applied as above described, absorbing gases of whatsoever kind, not requiring the presence of any other substance to resist its action, but without stint or scruple collecting noxious vapours from every source, not disguising, but condensing and oxidising the most offensive gases and poisonous effluvia, converting them into simple, inert, stable compounds; it is simple and economical, coming within the reach of the poorest, and can safely be placed in the hands of the most ignorant, thus combining advantages not possessed by any other disinfectant.

Production and Consumption of Iron.

A comparison of the quantities of iron produced in different countries during the twenty years ending with 1850, shows that the production of

Great Britain increased	244	per cent.
United States of America	171	"
France	141	"
German Customs Union	60	"
Austria	130	"
Belgium	217	"
Russia	20	per cent.
Sweden	51	"

and thus the production has increased more rapidly in every country than in Sweden, with the single exception of Russia.

During the year 1850

In the United States of America the consumption was	per head	88 lbs.
Great Britain	"	81
France	"	36
Hanover and Oldenburg	"	29
German Customs Union	"	24
Switzerland	"	18
Sweden	"	11½
Austria	"	11
Russia	"	8

Exports of British Iron, including Unwrought Steel, but not including Machinery and Mill-work.

Where to.	Years 1851.	1852.
	Tons.	Tons.
Colonies	159,709	141,460
United States	464,559	501,158
Other Countries	295,211	393,266
Total Tons	919,479	1,035,884

Hardware and Cutlery.

	£	£
Colonies	527,879	704,655
United States	1,080,487	968,493
Other Countries	1,218,645	1,018,549
Total	2,827,011	2,691,697
Quantity ... Tons	27,625	25,290
Total Value of Exports ... £	28,594,961	Incomplete.

On Some Stereoscopic Phenomena.

BY M. DOVE.

The author was chiefly induced to draw the attention of the Section to this subject in consequence of Sir David Brewster, who he greatly regretted was not at this meeting, having denied at the Belfast Meeting the soundness of the explanation which the author had given of the cause of the appearance of those bodies which exhibited the metallic lustre. This, he considered to arise from the superficial layers of particles being highly, though still imperfectly, transparent and permitting the inferior layers to be seen through them. This effect we see produced when many watch-glasses are laid in a heap, or when a plate of trasparent mica or talc being heated red hot is thus separated into multitudes of thin layers, each of which, of inconceivable thinness, is found to be highly transparent, while the entire plate assumes the lustre of a plate of silver. This explanation receives a very striking confirmation from the stereoscopic phenomena which he now drew attention to. He then presented to the Section and described a very simple and portable modification of the stereoscope, consisting of two lenticular prisms mounted in a frame like a double eye-glass. Upon examining with this two diagrams drawn one for the right, the other for the left eye, with lines suited to give the idea when viewed together of a pyramid, cube, cone, or other mathematical solid, but the lines on one drawn on a white ground, the other on a dark or coloured ground, on viewing them together the solid appeared with the metallic lustre. The author termed it "Glance." This, he conceived, demonstrated his original idea to be correct.

An Earthquake.

On the morning of the 8th February, 1855, about 7 A.M., the shock of an earthquake was felt at St. John's, Frederickton, and St. Stephens, New Brunswick; at Halifax, Windsor, and Picton, Nova Scotia; and at Charlottetown, Prince Edward Island. Several shocks have been felt, from the 1st February to the 19th, in many parts of the Union and the British Provinces.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—January, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg.* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch	Snow in Inch.
1	29·998	30·003	29·998	30·011	27°·4	28°·7	28°·5	28°·4	+ 3°·2	0·134	0·127	0·129	0·129	·88	·80	·81	·82	E b N	E	E b N	9·79	...	...
2	30·006	30·004	30·020	30·011	28·7	38·2	35·5	33·9	+ 8·6	·137	·137	·177	·148	87	60	86	77	E	E	E b N	5·39	...	...
3	30·026	29·991	29·888	29·963	33·7	44·5	37·5	38·0	+12·9	·149	·226	·184	·184	77	78	82	80	E b S	S E	Calm	1·60	...	...
4	29·797	·965	30·261	30·024	41·0	48·2	28·4	38·1	+13·0	·215	·319	·136	·210	84	95	87	88	Calm	NWbW	N b W	3·40	0·070	...
5	30·382	30·333	30·181	30·271	24·4	31·5	28·7	28·2	+ 3·0	·111	·145	·132	·132	82	81	82	84	Calm	E b N	E b N	10·93	0·040	...
6	29·975	29·898	29·799	29·881	35·5	45·8	44·9	41·9	+16·7	·192	·248	·269	·235	93	82	91	89	E b N	S S E	S E b S	4·40	0·015	...
7	·785	30·036	—	—	47·0	36·0	—	—	—	·312	·186	—	—	98	88	—	—	S W	W S W	—	9·40	...	...
8	30·552	30·454	30·279	30·394	21·9	33·2	30·2	27·6	+ 2·5	·103	·111	·150	·123	84	59	89	80	Calm	Calm	Calm	0·43	...	...
9	30·065	30·020	30·088	30·067	26·6	39·1	29·9	31·7	+ 6·6	·123	·138	·141	·131	83	58	84	73	Calm	W b S	Calm	6·32	...	...
10	30·275	30·213	29·935	30·127	21·1	25·1	24·1	23·2	— 1·8	·103	·114	·115	·108	89	82	86	84	N	S E b E	E S E	4·87	...	0·2
11	29·603	29·414	·302	29·427	25·1	31·8	31·0	30·0	+ 4·9	·121	·151	·162	·150	87	85	94	90	Calm	Calm	S W b S	1·55	0·040	...
12	·287	·294	·134	231	34·8	39·5	37·6	37·3	+12·2	·168	·205	·222	·199	84	86	99	90	Calm	Calm	Calm	0·00	...	0·2
13	·020	·316	·728	·404	30·9	25·1	14·7	21·9	— 3·2	·158	·076	·072	·096	92	55	80	75	N W	NWbW	NWbW	18·50	...	...
14	·903	·780	—	—	—4·7	16·0	—	—	—	·028	·070	—	—	73	74	—	—	N b E	S S W	—	6·92	...	0·2
15	·480	·496	·621	·539	24·4	29·2	25·6	26·4	+ 1·3	·089	·133	·125	·115	65	81	88	78	W S W	W b S	NWbW	3·82	...	0·7
16	·619	·712	·714	·691	17·2	25·1	24·8	22·3	— 2·7	·090	·105	·120	·106	91	76	88	85	NEbN	Calm	S E	4·02	...	0·3
17	·390	·304	·364	·350	29·4	38·4	33·0	33·6	+ 8·5	·139	·189	·173	·165	86	81	93	86	E	Calm	Calm	3·95	...	...
18	·393	·467	·537	·469	30 2	36·3	29·8	31·1	+ 6·1	·150	·138	·140	·137	89	64	84	78	Calm	SW bW	NWbW	7·94	...	Inap.
19	·558	·504	·475	·505	26·6	28·4	21·9	25·3	+ 0·5	·134	·105	·085	·109	91	66	70	78	W N W	N W	Calm	5·73	...	...
20	·332	·333	·483	·389	22·3	27·3	29·5	26·6	+ 1·8	·110	·127	·152	·131	88	84	94	89	Calm	N N W	SW bW	1·00	...	Inap.
21	·529	·231	—	—	27·7	28·0	—	—	—	·131	·134	—	—	86	87	—	—	N b E	E N E	—	14·40	0·360	3·0
22	28·717	·036	·411	·097	29·1	25 1	14·0	21·0	— 3·7	·149	·120	·078	·107	94	87	89	89	W S W	SW bW	SW bW	17·39	...	...
23	29.571	·621	·688	·633	5·4	15·1	10·4	9·9	—14·7	·056	·067	·065	·060	90	73	88	81	W	W S W	W b N	6·77	...	...
24	·676	·662	·712	·687	3·6	20·2	8·8	10·4	—14·2	·047	·072	·036	·051	84	64	52	67	Calm	W S W	Calm	2·90	...	...
25	·693	·495	·328	·482	4·0	22·6	21·9	16·8	— 7·9	·053	·102	·102	·086	92	82	84	83	Calm	N W	N	7·87	...	7·0
26	·124	·066	·042	·076	18·3	21·5	10·1	17·0	— 7·5	·091	·101	·064	·087	88	84	88	88	N	N	N N W	15·87	...	3·5
27	·131	·197	·334	·234	12·9	19·9	16·4	16·1	— 8·3	·063	·076	·086	·074	76	69	96	76	W N W	W N W	W S W	13·91	...	0·1
28	·348	·314	—	—	14·0	27·3	—	—	—	·075	·130	—	—	85	90	—	—	W N W	E b S	—	10·52	...	5·5
29	28·917	·034	·247	·080	26·9	23·3	20·2	23·3	— 0·9	·137	·115	·101	·117	93	88	90	91	N b E	S W b S	SW bW	16·52	...	2·0
30	29·385	·439	·593	·492	16·5	21·5	21·2	19·8	— 4·3	·076	·092	·103	·092	78	77	88	83	SW bW	SW bW	W S W	14·58	...	0·4
31	·686	·741	·774	·730	22·8	26·9	16·7	20·9	— 3·1	·111	·121	·073	·096	87	81	74	81	W S W	N N W	N	7·20	...	0·2
M	29·617	29·630	29·664	29·639	23·7	30.1	25·0	25·9	+ 1·1	0·119	0·136	0·126	0·125	86	76	85	82	6·93	8·22	7·23	7·67	0·525	23·3

Highest Barometer...... 30·552, at 6 a. m. on 8th } Monthly range:
Lowest Barometer....... 28·717, at 6 a.m. on 22nd } 1·835 inches.
Highest registered temperature 49°·0, at a.m. on 7th } Monthly range:
Lowest registered temperature —5°·4, at a.m. on 14th } 54°·4.
Mean Maximum Thermometer............ 32°·83 } Mean daily range:
Mean Minimum Thermometer............ 17°·54 } 15°·29.
Greatest daily range.........35°·0, from a.m. of 13th to a.m. of 14th.
Least daily range .... 5°·6, from p.m. of 1st, to a.m. of 2nd.
Warmest day....... 6th. Mean temperature...... 41°·87 } Difference,
Coldest day......... 23rd. Mean temperature...... 9°·95 } 31°·92.
Greatest intensity of Solar Radiation, 54°·0 on p.m. of 3rd } Range,
Lowest point of Terrestrial Radiation, —7°·8 on a. m. of 14th } 61°·8.
Aurora observed on 1 night: viz. 24th.
Possible to see Aurora on 8 nights.
Impossible to see Aurora on 23 nights.
Raining on 5 days. Raining 9·8 hours; depth, 0·525 inches.
Snowing on 13 days. Snowing 70·1 hours; depth 23·3 inches.
Mean of Cloudiness, 0·79.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1437·11	2890·78	1200·84	1525·57

Mean direction of the Wind, W 10° N.
Mean velocity of the Wind, 7·67 miles per hour.
Maximum velocity, 31·3 miles per hour, from 9 to 10 a. m. on 21st.
Most windy day, the 13th; mean velocity, 18·50 miles per hour.
Least windy day, the 12th; mean velocity, 0·00 " "

The early part of this month was remarkably fine and mild, being distinguished by very high readings of the Barometer. On the 8th, at 6 a.m., the reading was 30°·552, being the highest on record, and the mean for that whole day 30°·3942, is also the highest recorded. A great depression succeeded, reaching its lowest point between the 21st and 22nd, from which period the character of the weather changed to cold and stormy, with downfalls of snow, high winds prevailing for the next 14 days, and giving a mean velocity for that period of 11·48 miles per hour.

The monthly range of the Barometer (1·835 inches) is the greatest recorded: the temperature on the whole is 1°·6 above the average; and the fall of rain is 1·176 inches less, and that of snow 9·9 inches more than the mean of 15 years.

Comparative Table for January.

YEAR.	Temperature. Mean.	Dif. from Av'ge.	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind. Mean Velocity.	
1840	17·0	—7·3	40·6	—13·8	54·4	4	1·395	11	...	...	
1841	25·6	+1·3	41·7	— 4·1	45·8	2	2·150	14	...	0·36	lb.
1842	27·9	+3·6	45·8	+ 1·3	44·5	5	2·170	9	...	0·78	lb.
1843	28·7	+4·4	54·4	+ 1·5	52·9	6	4·295	12	14·2	0·69	lb.
1844	20·2	—4·1	44·6	— 7·7	52·3	7	3·005	11	24·9	0·70	lb.
1845	26·5	+2·2	43·0	— 3·4	46·4	5	Impf.	9	22·7	0·70	lb.
1846	26·7	+2·4	41·2	+ 0·3	40·9	5	2·335	10	6·0	0·55	lb.
1847	23·3	—1·0	42·6	— 2·2	44·8	7	2·135	5	7·5	1·09	lb.
1848	28·7	+4·4	51·5	—12·0	63·5	7	2·245	8	7·1	5·82	Miles.
1849	18·5	—5·8	40·1	—15·2	55·3	4	1·175	10	9·2	6·71	Miles.
1850	29·7	+5·4	46·3	+10·6	35·7	5	1·250	8	5·2	5·80	Miles.
1851	25 5	+1·2	43·2	—12·8	56·0	4	1·275	10	7·8	7·69	Miles.
1852	18·4	—5·9	37·3	— 7·0	44·3	0	0·000	19	30·9	7·67	Miles.
1853	23·0	—1·3	40·9	— 6·6	47·5	1	0·290	6	7·5	6·34	Miles.
1854	23·6	—0·7	45·2	— 4·3	49·5	7	1·270	11	7·5	6·86	Miles.
1855	25·9	+1·6	48·2	— 4·7	52·9	5	0·525	13	23·3	7·67	Miles.
										0·70	lbs.
M'n.	24·32		44·16	—5·01	49·17	4·6	1·701	10·4	13·4	6·82	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——January, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	30·390	30·505	30·500	4·8	17·2	7·6	·051	·089	·062	·85	·84	·90	N W b N	E N E	N E b E	Calm	0·92	1·51	...	...	Clear.	Cir. Cum. 4.	Cir Cum. 5.
2	30·511	30·490	30·462	2·2	10·0	5·2	051	062	058	95	80	90	N E b E	N E b E	N E b E	6·25	16·00	3·75	...	...	Cir. Str. 6.	Cir. Str. 10.	Light Cir.*
3	30·422	30·411	30·339	9·0	34·1	25·1	067	204	129	91	94	81	N E b N	S E b S	S E b S	10·73	Calm	Calm	...	...	Clear.	Clear.	Clear.
4	30·193	30·140	30·292	11·7	34·1	36·4	085	204	210	88	94	90	S E	N E	W	Calm	Calm	0·81	Inap.	...	Fog.	Hazy.	Str. 10.†
5	30·700	30·614	30·540	14·6	32·1	28·4	101	191	161	94	91	89	N E b N	N E b N	N E b N	3·62	Calm	0·05	...	...	Clear.	Clear.	Cir. 4 P.M.
6	30·561	30·585	30·386	26·2	30·1	32·1	160	177	191	96	95	96	N E b N	S S E	S S E	11·24	4·85	6·27	...	...	Str. 8.	Sleet.	Cir. Str. 4.
7	30·150	30·142	30·300	37·2	38·0	34·7	218	236	203	90	96	94	S S E	S S E	W b S	10·92	5·62	3·91	0·080	...	Do. 9.	Rain.	Cir. Str. 9.
8	30·685	30·651	30·721	21·2	32·4	18·4	118	191	117	88	87	93	W b N	W b N	W b S	11·65	0·76	1·12	...	...	Clear.	Clear.	Clear.
9	30·330	30·198	30·145	11·4	29·0	32·6	090	156	182	92	87	91	N E	E	W S W	0·03	Calm	1·12	...	...	Str. 9.	Str. 4.	Do.
10	30·550	30·524	30.341	3·0	12·6	0·6	048	078	043	84	90	90	N W b W	W N W	W	12·77	2·90	Calm	...	...	Clear.	Clear.	Do. Auro. Bor.
11	29·999	29·846	29·560	– 0·2	12·1	15·6	044	061	088	95	70	91	N E	N E b E	E N E	0·82	1·11	Calm	...	...	Str. 9.	Do.	Str. 10.
12	·611	·584	·600	17·0	36·4	26·4	102	218	154	86	90	91	N E	N E b E	N E b E	0·25	Calm	0·25	...	1·60	Do. 2.	Snow.	Do. 10.
13	·280	·141	·694	37·0	37·9	9·4	220	226	060	94	90	80	S b E	W	W N W	4·62	4·93	16·85	0·516	...	Rain.	Rain.	Clear.
14	30·090	30·085	30·080	–16·5	– 5·6	– 9·0	020	038	029	90	89	94	W b N	W	W	26·42	10·13	18·46	...	...	Clear.	Clear.	Do.
15	29·784	29·846	29·900	– 5·0	6·0	6·2	031	059	060	85	90	96	N E b E	N E b E	N E b E	3·68	1·46	Inap.	...	3·00	Snow.	Snow.	Str. 8.
16	30·040	30·039	30 060	– 0·8	8·0	7·5	044	063	062	90	89	92	N E b E	N E b E	N E b E	6·36	6·43	11·20	...	Inap.	Str. 10.	Sl'gt snow.	Do. 10.
17	30·020	29·845	29·781	7·3	14·8	29·0	062	087	159	93	90	96	N E b E	N E b E	S b E	8·89	7·50	5·00	...	1·60	Do. 10.	Snow.	Do. 10.
18	29·750	·698	·680	20·6	23·3	20·1	112	125	110	98	95	96	N E b E	N E	N E b N	3·73	4·16	11·62	...	Inap.	Do. 8.	Sl't snow.	Do. 10.
19	·610	·510	·521	23·9	29·2	28·9	125	159	139	95	96	96	N W b W	N W b W	W N W	4·00	0·51	5·18	...	...	Do. 10.	Str. 10.	Do. 10.
20	·501	·500	·546	20·0	29·4	28·6	110	159	145	94	93	89	W b N	W b N	W b N	13·88	0·14	1·11	...	...	Do. 10.	Do. 6.	Do. 10.
21	·884	·880	·719	20·1	28·6	22·5	118	170	136	88	94	94	N E b E	N E b E	N E b E	1·07	1·51	2·41	...	...	Cir. Str. 8.	Cum. Str. 4.	Snow.
22	·050	·060	·470	35·0	33·0	20·0	213	178	107	94	86	82	S E	W S W	W S W	14·68	6·52	18·75	0·840	1·20	Rain.	Cum. Str. 4.	Clear.
23	·833	·891	.910	11·0	23·6	20·0	082	135	114	88	90	87	W	S W b W	S W b W	6 25	0·70	0·70	...	...	Cir. Str. 4.	Cir. 2.	Cum. Str. 8.
24	30·001	30·050	·985	10·0	24·5	11·0	079	115	087	88	80	92	S	S S E	N E b E	7·12	Calm	Inap.	...	...	Clear.	Clear.	Clear.
25	29·935	29·900	·836	1·0	25·0	12·0	048	104	043	90	70	89	N E b N	N E b N	N E b E	Calm	Calm	Calm	...	...	Cir. Str. 4.	Do.	Str. 10.
26	·690	·536	·240	9·6	15·1	15·0	068	088	088	90	93	94	N E b E	N E b E	N E b E	2·64	2·63	27·46	...	...	Str. 10.	Snow.	Snow.
27	·092	·210	·450	18·1	28·4	5·0	106	152	058	94	96	98	W N W	W S W	W S W	18.32	12·27	4·28	...	11·30	Snow.	Do.	Clear.
28	·750	·871	·890	9·0	15·3	11·9	067	081	075	94	85	90	S W b S	N E b E	N E b E	Calm	0·37	7·00	...	...	Str. 10.	Cir. Str. 4.	Cir. 2.
29	·521	·340	·505	16·2	3·2	27·0	091	191	119	94	93	84	N E b E	N E b E	W S W	23·62	11·62	9·29	...	1·40	Snow.	Cir. Cum. Str. 4	Cir. Cum. 4.
30	·630	·630	·660	18·0	29·0	19·2	106	152	117	87	85	93	S b W	W S W	S W	12·39	4·37	21·50	...	...	Cum. Str. 10.	Cum. Str. 4.	Cum. Str. 6.
31	·795	·840	·948	17·4	18·2	4.6	106	105	051	88	87	89	W S W	W N W	N W	16·80	11·25	12·73	...	...	Do. 4.	Do. 2.	Cir. 2.‡

Barometer ....
- Highest, the 8th day .... 30·721
- Lowest, the 22nd day .... 29·050
- Monthly Mean .... 29·926
- " Range .... 1·671

Thermometer.
- Highest, the 7th day .... 44°·7
- Lowest, the 14th day .... —16°·5
- Monthly Mean .... 17°·88
- " Range .... 61°·2
- Mean Humidity .... ·897

Greatest Intensity of the Sun's Rays .... 114°·8

Rain fell on 4 days, amounting to 1·436 inches. Raining 25 hours, 5 minutes.

Snow fell on 8 days, amounting to 20·10 inches. Snowing 78 hours 10 minutes.

Most prevalent Wind, N.E.bE. Least prevalent Wind, E.

Most Windy Day, the 14th day; mean miles per hour, 18·33.

Least Windy Day, the 25th day; mean miles per hour, 0.00

Aurora Borealis visible on 1 night. Might have been seen on 14 nights.

Lunar Halo visible on 2 nights.

Slight shock of an Earthquake on the 13th day, at 5·40 a.m.

The Electrical state of the atmosphere has been marked by moderate intensity, and during the snow storm of the 15th and 27th, indicated a high tension of a negative character.

The amount of *Ozone* has been rather less than usual.

* Lunar Halo, diameter 44°·4. † Rain at 5·40 p.m. ‡ Lunar Halo, diameter 74°·0

Monthly Meteorological Register, Quebec, Canada East, January, 1855.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.	A.M.	P.M.	10 P.M.		
					°	°	°	°																
1	30·233	30·369	30·478	30·360	0·4	10·1	8·1	6·2	0·042	0·066	0·096	0·068	87	91	63	80	Calm.	E N E	E N E	0 0	6·2	7·2	...	...
2	30·530	30·471	30·449	30·483	4·2	10·0	13·9	9·4	·095	·063	·084	·081	53	86	96	78	E N E	N E	N N W	13·9	14·3	8·8	...	...
3	30·369	30·232	30·166	30·256	18·3	27·3	26·1	23·9	·081	·126	·131	·113	82	84	90	85	Calm.	S W	N W	0·0	3·8	3·8	...	...
4	30·110	29·962	30·046	30·039	22·5	33·0	34·8	30·1	·120	·167	·194	·160	96	89	96	94	W	S W	Calm.	3·8	2·0	0·0	·198	...
5	30·328	30·595	30·730	30·551	21·0	17·8	11·5	16·8	·106	·089	·071	·089	90	86	91	89	N N E	Calm.	N E	11·3	0·0	7·2	·052	Inap
6	30·695	30·490	30·327	30·504	9·7	16·2	21·1	15·7	·100	·077	·115	·097	70	80	99	86	N E	E N E	Calm.	16·0	17·9	0·0	...	...
7	30·115	29·819	30·009	29·981	32·5	43·7	35·7	37·3	·163	·234	·188	·195	89	84	90	88	Calm.	W	W	0·0	2·0	10·1	·092	...
8	30·302	30·536	30·559	30·466	26·1	23·8	17·0	22·3	·108	·086	·088	·094	75	66	89	77	W	W	S W	26·6	5·2	3·8	...	...
9	30·318	30·037	29·840	30·065	12·6	23·7	25·8	20·7	·075	·105	·128	·103	91	80	89	87	N	Calm.	W N W	2·0	0·0	7·2	...	...
10	30·110	30·326	30·220	30·218	6·1	– 0·2	– 3·4	0·8	·026	·035	·036	·032	42	75	90	69	W	W N W	W	27·8	11·5	3·8	...	...
11	30·008	29·705	29·556	29·756	– 2·6	12·9	17·5	9·3	·038	·065	·081	·061	87	78	80	82	N W	S W	Calm.	2·0	2·0	0·0	...	1·1
12	29·442	·533	·531	·502	22·6	27·6	25·8	25·3	·120	·142	·129	·130	96	93	92	94	Calm.	Calm.	E N E	3·0	0·0	13·4	...	1·2
13	·266	28·968	·396	·208	29·2	33·2	0·8	21·1	·146	·169	·048	·121	91	89	95	92	E N E	Calm.	N W	11·3	0·0	21·3	·639	...
14	·663	29·855	·957	·825	–11·3	–10·1	–10 9	–10·8	·027	·026	·025	·026	93	87	87	89	N W	W N W	W N W	16·0	13·9	3·8	...	...
15	·851	·656	·793	·766	– 7·8	6·0	8·3	2·2	·033	·059	·066	·053	94	94	96	95	Calm.	N E	N E	0·0	2·0	8·8	...	3·0
16	·965	30·021	30·070	30·019	2·9	4.8	6·1	4·6	·040	·059	·063	·054	76	98	100	91	N E	N E	N E	11·3	25·4	19·7	...	0·5
17	30·077	29·975	29·852	29·968	5·8	9·7	13·2	9·6	·062	·070	·077	·070	100	96	91	96	N E	N E	N N E	22·7	27·8	22·7	...	2 0
18	29·793	·708	·590	·697	15·4	18·2	21·8	18·5	·090	·104	·116	·103	97	100	96	98	N E	N E	N E	13·9	27·8	39·2	...	15·0
19	·460	·279	·272	·337	28·0	28·6	28·2	28·3	·145	·137	·129	·137	95	87	83	88	N	N E	N E	11·3	42·5	9·3	...	6·0
20	·245	·260	·374	·293	25·9	28.5	24·8	26·4	·134	·134	·116	·128	94	86	85	88	Calm.	W N W	W N W	0·0	3·8	3·8	...	1·8
21	·528	·773	·690	·664	24·0	23·1	24·0	23·7	·112	·098	·115	·108	84	77	86	82	N W	Calm.	N E	3·8	0·0	7·2	...	2·0
22	·276	28·832	·324	·143	26·4	38·5	24·8	29·9	·134	·225	·102	·154	92	97	75	88	NE	N E	W N W	42·5	25·4	22·7	·528	0·6
23	·646	29·721	·856	·741	13·0	18·9	14·4	15·4	·074	·079	·086	·080	88	74	97	86	W S W	W S W	Calm.	6·2	3·8	0·0	...	...
24	·923	·873	·844	·880	6·7	17·2	12·9	12·3	·056	·085	·076	·072	87	84	91	87	S	N N E	Calm.	2·0	3·8	0·0	...	...
25	·806	·733	·746	·762	4·8	15·3	15·4	11·8	·059	·079	·084	·074	100	85	88	91	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...
26	·706	·556	·224	·495	6·6	15·5	14·6	12·2	.062	·067	·090	·073	97	73	100	90	Calm.	N E	N E	0·0	30·1	34·1	...	4·0
27	28·768	28·920	·336	·008	20·3	25·1	12·1	19·2	·113	·120	·074	·102	98	87	92	92	N E	W S W	W S W	50·8	3·8	7·2	...	2·5
28	29·631	29·817	·900	·783	5·2	14·1	14·4	11·2	·061	·075	·084	·073	98	84	95	92	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...
29	·761	·423	·270	·485	19·4	29·0	34·9	27·8	·107	·136	·178	·140	98	84	89	90	N E	E N E	Calm.	50·8	48·1	0·0	·100	1·0
30	·476	·421	·450	·449	25·0	24·6	20·8	23·5	·106	·102	·094	·101	80	75	82	79	S W	S	S W	11·3	3·8	10·0	...	0.4
31	·505	·555	·760	·607	18·7	16·8	3·8	13.1	·084	·073	·044	·067	80	74	78	77	N W	W N W	Calm.	11·3	21·3	0·0	...	...
	29·835	29·788	29·826	29·8164	13·92	19·45	16·72	16·70	0·088	0·102	0·097	0·096	87	85	89	87				10·70	11·17	8·87	1·609	41·1

REMARKS.

5th. Corona round moon at 10 p.m. Found that at 15 feet above the level of the high water mark the reduced height of the Barometer at 10 p.m. was 31·058 inches.

8th. Lunar Halo 50° in diameter at 12 p.m.

9th. Aurora observed at 2 a.m., not visible at 11*h*. 30*m*. p.m.

13th. Between 7 p.m. and 8*h*. 30*m*. p.m. the Thermometer fell 23°.

22d. At 3*h*. 30*m*. p.m. wind which was blowing a gale from N. E. suddenly changed to the N. W. blowing with equal force.

28th. Lunar Halo 25° in diameter at 9 p.m.

29th. Between 9 and 10 p.m. thunder and lightning with heavy rain and wind, at 10 p.m. wind suddenly became calm.

Maximum Barometer, 10 p.m. on the 5th	30·730
Minimum Barometer, 6 a.m. on the 27th,	28·768
Monthly Range	1·962
Monthly Mean	29·8164
Maximum Thermometer on the 7th	46° 0
Minimum Thermometer on the 14th	—14·3
Monthly Range	60·3
Mean Maximum Thermometer	23·39
Mean Minimum Thermometer	8·07
Mean Daily Range	15·32
Mean Monthly Temperature	16·70

Greatest Daily Range of Thermometer on 13th	48°·5
Least Daily Range of Thermomter on 19th	3°·5
Warmest Day, 7th. Mean Temperature	37·3
Coldest Day, 14th. Mean Temperature	—10·77
Climatic Difference	48·07

Possible to see Aurora on 10 Nights.
Aurora visible on 4 Nights.
Total quantity of Rain, 1·609 inches.
Total quantity of Snow, 41·1 inches.
Rain fell on 6 days.
Snow fell on 15 days.

The Canadian Journal.

TORONTO, APRIL, 1855.

Passing Visits to the Rice Lake, Humber River, Grenadier's Pond, and the Island.

MADE BY DR. GOADBY AND J. BOVELL, M.D., TRIN. COLL., TORONTO.

(*Specimens exhibited before the Canadian Institute, Dec. 17th*, 1854.)

We devoted one fine morning to a hasty visit to Rice Lake to fish: we spent about three hours there, and on our return we directed our attention to collecting things microscopical.

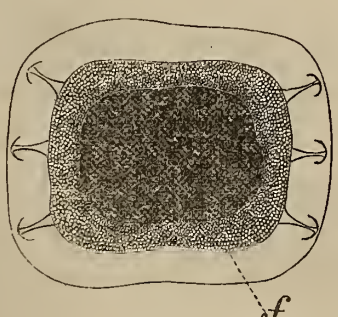
A gentleman, who accompanied us, had long resided at the Lake, and described a peculiar jelly-looking substance which he had seen on a submerged stick, and undertook to row us to the very spot; he did so, and introduced us to a magnificent Polypidom of Plumatella! It measures eight inches by five inches, and necessarily contains many thousands of Polypes.

The Plumatella is a Bryozoon, or Ciliobranchiate Polype, that is to say its tentacles, or arms, are covered with vibratile cilia. Not being provided with a microscope, we could not make an examination on the spot, but had to convey the specimen home to Toronto; and here, even, circumstances prevented us working at it until nearly too late, as the animals died, and almost immediately decomposed. From what we did see, however, there is some reason to conclude that this species differs from the European animal, not merely in the form of the cells, but in the animal itself, which is certainly larger, and appears to possess a much greater number of tentacles.

In making microscopical examinations of thin slices of this Polypidom, we were struck with the appearance of a great number of bodies such as represented at *a*, and for some time we necessarily concluded that we were gazing upon the ova of the Polype, in various stages of developement, as shewn at *b* and *c*, in the same figure. The central mass is entirely, and densely dark, while the narrow, somewhat transparent margin seen at *a*, is remarkably cellular, being composed entirely of hexagonal cells, of much regularity in their form and size (*d*). These cells are again seen in *b*, at *f*, where, also,

a

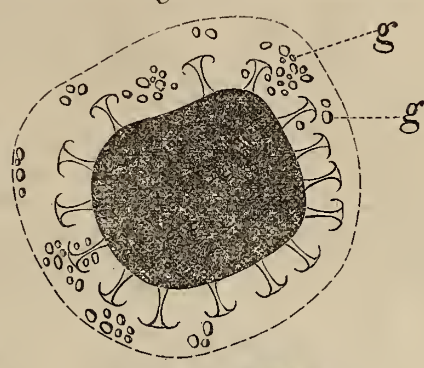
b



d

we see developed six hooks—three at either end; at *c*, the hooks appear to have attained their maximum developement. In examining the specimens by *direct light*, (as opaque objects), the cells are seen to be continuous over the entire surface. The presence of *cells* offers no objection to the animality of these bodies, whilst the *hooks* remind one so forcibly of the ovum of Cristatella mucedo, (a fresh water polype) as figured by the late Sir J. G. Dalyell, Bart., Raspail, Cornelius Varley, that it left little doubt these were the indubitable ova of the Plumatella, when, presently, several of the mature bodies appeared, their surface being more or less covered with *corpuscles of starch*, as shewn at *g. g.* in *c*—this was at

c



e

once conclusive of their *vegetable* character, and they necessarily resolve themselves into a new species of Xanthidium. An enlarged corpuscle of starch is shewn at *e*.

As compared with all other known species of Xanthidia, these are remarkable for the possession of a membrane, of inconceivable transparency and delicacy *beyond the* hooks, and, it is just possible that other species, if seen in a sufficiently fresh state, would also present a membrane of like tenuity; altogether, one cannot but regard these specimens as throwing much light on the true structure and affinities of such bodies in general, whose history has been hitherto involved in much obscurity.

A

b

In visiting the Humber Bay a new order of beauties awaited us, in the form of very minute (microscopical) algæ. A represents one of these singularly beautiful plants, which

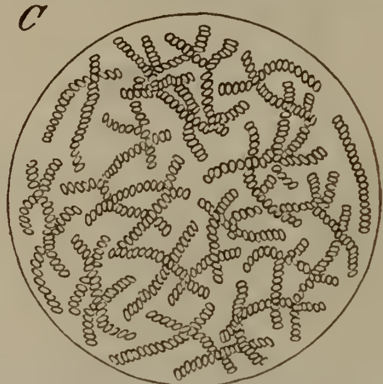
is parasitic upon the stems and leaves of other plants, decayed wood, &c. In shape it is perfectly circular, composed, apparently of radii from the centre to the circumference; the plant is beautifully and intensely green.

The element of this plant, as analyzed by much higher magnifying power is shewn at *b*, it consists of a number of cells, each one being nearly square, and containing a dense, square shaped nucleus—the series of cells taper up to an exceedingly fine point (*b*).

It is worthy of remark, that Dr. Leidy, of Philadelphia, has described, in a paper entitled " The flora and fauna within Animals," and published by the Smithsonian Institution, a plant very much resembling this, as having been found by him in the stomach of one species of Julus, *which is a vegetable feeder*; and as we find the plant existing in great abundance, we cannot but think that, so far from constituting a parasitical growth in the creatures stomach, that it had simply conveyed the specimens found, into its interior, as its legitimate food.

We found, also, a very singular plant perfectly spherical, and in that form we could gain no idea of its structure; on making a section of it, it presented the appearance represented at *C*,—

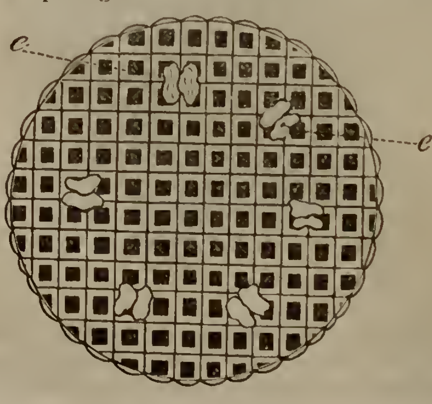
C



being composed of isolated strings of cells, which crossed each other in all directions. These cells are beautifully green, and contrast favourably with the remarkably diaphanous ground on which they are placed : one cannot at all see how these strings of cells are connected together, there is no appearance of membrane, and yet a definite form is given to the mass—doubtless, the very transparent something is the *collenchyma*, described by Mohl and Henfrey.

There is some doubt whether this be a perfect plant ; that the former specimen is so, admits of no doubt, as its surface was covered with sporangia.

D



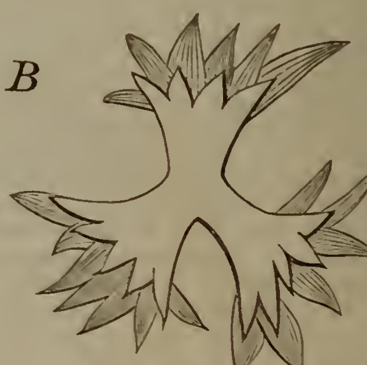
Another alga remains to be described; it is seen at D, and is as beautiful as its predecessors. The entire plant is discoid, such as represented; no section, or manipulation of any kind has been attempted here. It will be seen that the entire surface is divided into a series of square cells, each one containing a nucleus of densely coloured green matter—the regularity of these cells is very remarkable. That this is a perfect plant is evidenced by the sporangia shewn at *e*, *e*, which are really much more numerous on the original, than represented in the figure.

To the best of our belief, this and the preceeding plants are entirely new, not having been described by any one so far as we know.

From the Grenadier's pond we obtained a beautiful specimen of Conferva *in conjugation*, (zygnema quininum?) which latter fact gives it a sole claim to notice here. The cells of chlorophylle have been aggregated in the upper cells, and passed by the connecting tubes, developed for the purpose, into the lower series of cells which belong to the other plant, in which they appear as rounded masses.

This process accomplished, the inosculating lips part, and each plant walks away whither it will; it is most probable that the upper exhausted tubes are left to perish, whilst the developement of new growths takes place from the fecundated lower cells.

B

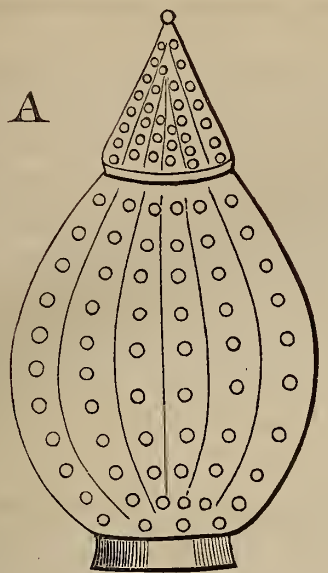


Many specimens of Spongia-fluviatilis we found, and amongst them a new species, if we may judge from the form of the siliceous spiculæ. B is a figure of a spiculum, remarkable for its tri-radiate character.

From a pond on the Island we obtained a Conferva, of singular minuteness, also caught in the act of conjugation, but the period is a very important one, namely, the large masses of chlorophyle are seen in transitu—tightly wedged in the tube which, for the present, connects the two plants.

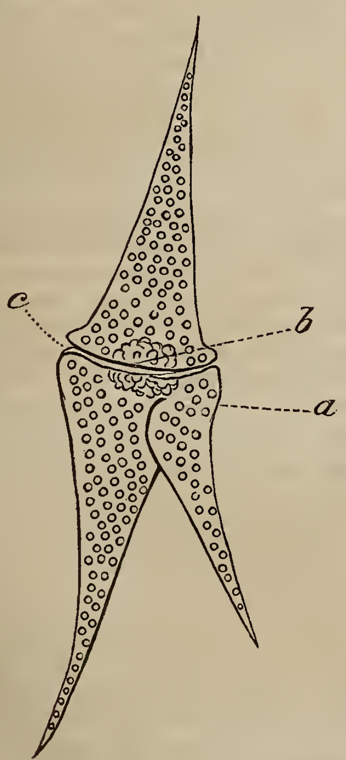
The Island of Barbadoes is remarkable for the possession of a Chalk containing a very large per centage of the (presumed) loricæ of extinct animalcules. Their size is (microscopically speaking) colossal, and they exhibit forms not found any where else in the known world. A figure of one of them, resembling a jar with a lid to it, is shewn at A.

A



Strangely enough, the Island ponds, opposite Toronto, favored us with specimens, also silicious, and bearing nearer affinity to the fossils of Barbadoes than any yet discovered, so far as we know.

B



B, represents one of these animals (?)—it was alive when we examined it, and moved about the field with a gliding motion. At *a*, is represented a limb which possesses a joint, by means of which it can open and shut at pleasure; *b*, shews a floculent mass, which gave an idea of *food*, while *c* represents a curious trumpet-shaped termination which, from the frequency of finding them, appears to be easily detached: finally, the entire surface is covered with very minute tubercles.

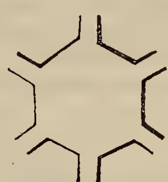
All the specimens here described, have been converted into permanent preparations, and it is hoped that the above description of them will prove interesting to the members of the Canadian Institute.

ADDITIONAL OBSERVATIONS BY J. BOVELL, M.D.

The Bear.

Within the last few weeks I have had the opportunity of examining the alimentary canal of the brown Bear of this Province, which presents some interesting points for observation.

First, the æsophagus.—This tube on being submitted to microscopic examination, furnishes an exception to the general rule with reference to the form of muscular fibre found in it. In works on Physiology and Anatomy, it is stated that striped muscular fibre exists in the upper third only; the lower portion possessing non-striped fibre.* Messrs. Todd and Bowman, however, observe, " In some specimens from the human subject, we have failed in detecting any (striped fibre) in the lower half of that tube, either in the circular or longitudinal layer; but in another example we have found them to within an inch of the stomach." Beale, in his Clinical Medicine, notices the presence of striped muscle in the æsophagus of tench. In the Bear I find that striped fibre exists throughout the whole tube, terminating in an abrupt line with its convexity towards the stomach. In the rest of the stomach and intestines there is ordinary plain fibre. The villi of the intestines are very varied in form. In the duodenum they are exceedingly elongated and densely packed; injected with chromate of lead their vascularity is beautifully shown, and the arrangement of the vessels at the base of each villus is distinctly brought out, and it appears that the vessels of all the villi are in communication; thus, supposing six villi placed together, the vessels at the base present the following arrangement:—



In this portion of the intestinal canal, they also present broad bases and very obtuse apices. In the ilium they are considerably smaller, and cluster in greater numbers on and around the raised margins of the Payerean Patches. In the large intestine the villi have disappeared, and, as in other animals, have more the appearance of a stomach; the net work of beautiful capillaries, rendering the organ intensely vascular. Here, however, is another peculiarity noticed,—along the whole length of this large tube an unbroken chain of glands, about one quarter of an inch in width, runs, having short villi covering the surface. This arrangement gives one the idea that the plain surface of the intestine may perform the office of a second stomach, while the long chain of glands is a real excretory apparatus.

The Lobster.

There is one other subject which I desire to bring before the Institute, with the view to obtain information. While engaged in dissecting a lobster, my attention was particularly directed

* I cannot procure a reference to Mr. Gulliver's papers.

to the branchial organs,—perceiving that the structure of the branchiæ was much more dense than seemed consistent with the character of a directly aerating surface, I endeavoured to open out the tubes for the purpose of more minute examination. In doing so, I easily divided the tubular case, but found an inner membrane lining it; by traction, this was completely withdrawn, presenting a perfect cast of the main tube and the small fringed tubules. On reference to Carpenter's Physiology, to the Encyclopædia of Anatomy, Seibold's Comparative Anatomy, and Jones's Animal Kingdom, I can find no allusion to such a membrane, although the illustration given by Mr. Jones, and taken from the Hunterian collection, would lead to the inference that Mr. Hunter knew of the existence of the structure in question. The following is Mr. Jones's account: "Setting out from the heart, we find that the blood goes to all parts of the body through the different arterial trunks, and by the great sternal artery is conveyed to the legs, foot-jaws, and false feet. But from this same artery vessels are furnished to the branchiæ. The branchial arteries, so divided, subdivide into secondary trunks, which ramify through the individual branchiæ and supply all their appended filaments." The blood-vessels could not ramify on the fibrous tube; the inner membrane, therefore, is the bed in which the vessels repose, the outer case being, like the cartilaginous rings of the branchial tubes, organs of support. How, then, is aeration effected under such circumstances? On placing the terminal branchia with the small appended tubules under the half-inch object glass, we find that the surface of each is even, and that the membrane is not perforated by foramina. Comparatively dense, therefore, as the substance is, it yet must permit the passage of gases through it; and, indeed, Professor Draper's experiments with membranes and septa equally dense, afford evidence that such must be the case. In the structure of the breathing organs of this class, we find an arrangement admirably adapted both to terrestrial and aquatic respiration. Living amongst shoals, and therefore liable to be left at times high and dry, the creature would undoubtedly perish, if provision was not made for its safety. The water, therefore, which enters the branchial chamber is retained for the purpose of moistening the bronchiæ, while atmospheric air has free access to the inner membrane through openings at the base of the principal branches.

Account of an Extraordinary Sudden Fall in the Waters of the Niagara River.

(Communicated to the Canadian Institute, by Major R. Lachlan, Montreal.)

In the paper on the Periodical Rise and Fall of the Lakes, which I had, last year, the honour of presenting to the Institute, I alluded to examples of the almost entire temporary obstruction of the different Lakes, and more particularly of Lakes Huron and Erie: and I proposed appending to that Essay, some account of one remarkable instance which occurred in March, 1848, between Buffalo and Fort Erie, at the head of the Niagara river. Circumstances having obliged me to postpone that intention, I now beg to be allowed to redeem my pledge, by laying before the Association the document in question, as of considerable philosophical interest,—though possessing no literary merit—and therefore sufficiently deserving of being placed on permanent record. And, to add somewhat to the value of such a paper, I prefix thereto, a sketch map of the course of the Niagara River, from its efflux from Lake Erie, to its junction with Lake Ontario, as likely to make the whole subject more readily understood.

I need only add, by way of further introduction, that, as stated in my paper on the Rise and Fall of the Lakes,* I was so much struck with the notices of this singular phenomenon which appeared in neighbouring local journals, immediately after its occurrence, that I was induced to write to a friend residing in the vicinity, for further information on the subject; and that this paper will consequently be found to consist of two distinct parts: the one composed of the particulars gleaned from the public prints; the other consisting of the additional information acquired from the gentleman alluded to; and that, as done on other occasions, I have allowed my authorities to speak for themselves, in their own language, in preference to putting together any second description of my own.

With regard to the first branch of the subject, my notes proceed as follows:—

I.

The following particulars respecting the extraordinary obstruction of the waters of the Niagara River, in the winter of 1848, were gleaned from a telegraphic despatch, dated Queenston, 30th., and the *Buffalo Commercial Advertiser* and *Buffalo Express* of the 31st of March:

"This morning, (30th March) was witnessed on the Niagara River, an unprecedented spectacle of wonder, long to be remembered in connexion with the Falls. Suddenly, the water fell to a considerable extent, so that the Table rock was sufficiently dry to enable those who were fortunate enough to be in the vicinity, to go so far across the river, as to be directly over the tremendous rock. This truly astonishing feat was accomplished, among others, by ladies; and although the water in some degree returned the same day, a memento of their journey towards the horse-shoe centre, was left, in the form of a pole erected thereon.

"The villagers of Chippewa (about two miles above the Falls) thought they had entirely lost their creek. Off the old Chippewa fort, about one hundred feet beyond the usual low-water mark, was discovered a burning spring, in the bed of the Niagara, which some one had the curiosity to enclose with an old potash kettle, with a gun-barrel knitted therein,† and succeeded in producing flames, and a loud explosion. Several bayonets, muskets, swords, &c., were also picked up. The water returned to nearly its usual level in the course of the day.

"The cause of this occurrence was conjectured to be an accumulation of ice at the egress of the river from Lake Erie having for a time closed up the outlet—and such proved to be the case: it being stated in the *Buffalo Commercial Advertiser* of the 31st of March, that the river at Black-rock (about three miles below Buffalo) fell 3 feet on the night of the 29th, and rose about six inches on the 30th: and that they were at a loss to account for this, unless the ice had been packed in some place, so as to obstruct the stream. There had, however, been no remarkable variation in the harbour; and this fact increased the perplexity. At the Falls there was an unprecedented and most plentiful *lack* of water. The creek at Buffalo rose about 6 inches on the 31st."

*See Canadian Journal, vol. 2, p. 293 &c.: but more particularly p. 304.

† The hint must have been taken from a somewhat similar plan having been adopted with a gas-evolving spring, well known to travellers in the vicinity of Chippewa.

2. The following additional interesting details are from the *Buffalo Express* of the 31st, and appear to have been derived from a correspondent at the American village of Niagara Falls, describing the passing events of the preceding day.

"The Falls of Niagara can be compared to nothing but a mere mill-dam, this morning. In the memory of the oldest inhabitant, never was there so little water running over Niagara's precipice as at this moment. Hundreds of people are now looking at that which never had been, and probably never may again be seen. Last night, at 11 o'clock, the factories fed from this majestic river were in full operation: and at twelve o'clock the water was shut off: the wheels suddenly ceased their revolutions: and everything was hushed in silence, except a faint roar of the maddened waters of the Cataract. When the fact was known, astonishment was depicted in every countenance.

"To give some idea of the lowness of the water, Messrs. G. Mamlin and Woodruff this morning rode in a buggy one-third of the way across the river, from the head of Goat-island towards the Canada shore. The wheeling was excellent; the rock being as level as a floor. They drove outside of the island, towards Allan's island, and turned round; a thing which had never before occurred."

3. The following additional particulars are extracted from the *Iris* newspaper (published at the American village of Niagara Falls) of the 31st March :

"The Table rock, and some two hundred yards more, were left dry; islands, and places where man never before dared to tread, were visited—flags placed upon some, and mementos brought away from others.

"Judge Porter, with his troop of blasters, under their active and efficient foreman, James Macafee, were early in the canals (or races) leading to the Mills and Factories; when the thunders of the blast was heard all day on a spot where never before stepped the foot of man; and where, heretofore, the reeking waters forbade too near approach, they now worked with safety on dry land.

(Below the Falls also.) "Rocks, which at very low water had sometimes touched the keel of the steamer "Maid of the Mist," and for the removal of which the captain had made liberal offers, were blown to pieces, and removed with the same ease as if it had been on dry land.

"The cause of this wonderful fall in the waters of the Niagara can only be accounted for by supposing that the large fields of ice in the lower end of Lake Erie had moved down bodily, and formed a sort of dam, between Fort Erie and Buffalo. The water is still low, but gradually rising."

II.

My curiosity being naturally much excited, and little satisfied by the perusal of the foregoing interesting notices, I resolved to endeavour to learn some further particulars, and I, accordingly, on the 11th of May following, addressed a note to a friend residing in the neighbourhood of Fort Erie, (Mr. E. Anderson, now Collector of Customs at Amherstburg) begging that, in addition to stating how far the newspaper accounts were correct, he would kindly endeavour to clear up the following points :— 1. How it was that, as stated in the *Buffalo Advertiser*, though the river fell 3 feet at Black-rock, there was still no remarkable variation in the harbour of Buffalo. 2. Whether the jam, supposed, in the *Iris*, to have taken place, did actually occur between Fort Eric and Buffalo, and if not, where and when did it take place. 3. What is the usual difference of level in the water at Black-rock, compared with the head of the Rapids and the harbour at Buffalo. 4. Whether any of the old inhabitants of the neighbourhood had any recollection of a similar occurrence; and if so, how long ago, and how often within their memory.

To this letter, I was obligingly favoured with a reply, from which I extract the following valuable and interesting particulars :—

1. "The phenomenon you refer to, I recollect perfectly well, as I had the curiosity to go up to the Rapids at the time it happened, for the purpose of examining the ice, &c., and I would say that the accounts of it in the Buffalo and Niagara Falls newspapers are correct.

"Some years ago, the State of New York built a sea-wall from the American side of the Niagara River, to Bird-island Reef, to form a feeder for the Erie Canal, which made the exit of Lake Erie much more narrow than the natural bed of the river. In the centre of the river, between old Fort Erie, on the Canada side, and the head of the sea-wall on the American side, is a large reef of rocks, not more than two feet under water; and on each side of this reef are two channels, in one of which there is ten feet water, and in the other, on the American side, 8 feet water.

2. "When I went to examine the Rapids, the main channel opposite old Fort Erie, was completely jammed with large cakes of ice, piled one on top of the other; and the Lake as far as the eye could carry, was in the same state, but more so on the Canadian shore than the American. This will account for the water falling $3\frac{1}{2}$ feet below the usual level of the river. You will also recollect that there is a large creek running into the harbour at Buffalo, that would tend to keep the water up to the usual height *there*.

3. "The difference of level between Buffalo harbour, and the Niagara River below the Rapids is 5 feet. I do not know that there is any between the head of the Rapids and Buffalo.

4. "The phenomenon lasted nearly two days. Colonel Kirby, (Collector of the Customs) one of the oldest inhabitants of Fort Erie, has no recollection of anything of the kind before this."

To the above may be added, that it was on this occasion, as I afterwards learnt, that the Niagara, after indignantly bursting its temporary winter chains, continued rushing furiously on from the Falls in an accumulated roaring avalanche of crashing ice and foaming waters of great height, past Queenston and Niagara, sweeping along with it whatever trees, rocks, mills, and wharves lined the banks, until it at length settled calmly down on the broad bosom of Lake Ontario.

Such is the amount of the information acquired by me, at this remote distance, regarding this extraordinary phenomenon; but I have no doubt that many members of the Institute, residing nearer the scene of so singular and startling an event may be able to furnish more satisfactory particulars. I may, however, at all events, trust, that having frankly led the way, my humble *mite* will prove acceptable, and that those who are better informed will be disposed to follow my example, as regards not only this, but many other inviting and interesting CANADIAN objects of philosophical investigation.

Remarks on the Planetoids between Mars and Jupiter.

Read before the Canadian Institute, by T. Henning, Esq., March 10, 1855.

Astronomy is, and ever must be, a study of deepest interest,—wide in its range, fascinating in its details, startling in its conclusions. Of all the sciences, perhaps, it has of late years made the most rapid progress. The discovery of new satellites, the facts respecting single stars and binary systems, the revelations of the telescope in regard to the nebulæ, and, lastly, the vast number of cosmical bodies which are found to be revolving in space in obedience to the laws that guide and control the system to which the earth belongs—all indicate the rapid strides which the astronomer is making, and furnish fresh matter for wonder and gratification. It is to the last of these—the numerous planet-like bodies which have of late been detected as they performed their annual course—that I would for a few minutes direct your thoughts this evening, not with the view of propounding any new theories, but chiefly for the purpose of filling a gap which has inadvertently occurred in the Papers reckoned on by the Council.

HISTORY OF THE PLANETOIDS.

Humboldt tells us that it was an opinion of Hellenic antiquity that there were far more than five planets—that many might remain unseen on account of the feebleness of their light and their position. However this may be, it is certain that as early as the days of Kepler, it was surmised that some unseen planets occupied the space that separated Mars from Jupiter. "I have become daring," says he, in a work written at the youthful age of 25, "and place a new planet between Jupiter and Mars, as also (a conjecture less fortunate in its result) another planet between Venus and Mercury; neither of these have been seen, probably on account of their extreme smallness."

Towards the close of the last century, when the distances of the planets from each other and the laws which regulated these distances came to be more intelligently discussed, it was discovered that the surmises of Kepler were correct, and the arithmetical progression at which he hinted was fully examined and dignified with the appellation of a *law*. This numerical relation, which usually receives the name of Bode's *law* of distances, both Lalande and Delambre call "a play of numbers," and others merely "a help for the memory." It holds, however, so prominent a place in connection with the asteroids, that a few observations regarding it may be necessary.

Commencing with Mercury, the planet nearest the Sun—the grand centre of our system—and passing on from planet to planet, there is a ratio of distance between each, which holds true till we reach the orbit of Mars. A mighty gulph of no less than 350,000,000 of miles is then reached, in which no planet was supposed to revolve, and in which the duple progression failed. As soon, however, as the limits of this intervening space were passed, this curious law again prevailed. Although the succession of distances "does not correspond precisely with a numerical series in duple progression, there is so striking an approximation to it as to produce a strong impression that it must be founded upon some physical cause, and not merely accidental." So thinks Dr. Lardner and many other distinguished astronomers. Bode, however, whose name is so connected with this supposed law, was not even its modern discoverer, for he has stated in one of his works, that "he had taken the law of the distances from a translation of Bonnet's 'Contemplation de la Nature,' prepared by Professor Titius at Wittenberg." In a note added to a certain chapter of the work referred to (which appeared in 1772), and which I quote as found in the fourth volume of the "Cosmos," for the purpose of showing what was the scheme proposed to represent the distances of the planets, Professor Titius says—"When the distances of the planets are examined, it is found that they are almost all removed from each other by distances which are in the same proportion as their magnitudes increase. If the distance from Saturn to the Sun is taken as 100 parts, the distance of Mercury from the Sun is 4 such parts (how the Professor obtained the number 4 for the orbit of Mercury is not stated); that of Venus 4+3=7 such parts; the Earth 4+6=10; Mars 4+12=16. But from Mars to Jupiter there is a deviation from this accurate (!) progression. Mars is followed by a space of 4+24=28 such parts, in which neither a principal planet nor a subordinate planet has yet been seen. Is it possible that the Creator should have left this space empty? It cannot be doubted that this space belongs to yet undiscovered satellites of Mars; or that, perhaps, even Jupiter has further satellites around him, which have not hitherto been seen by any telescope. In this space, (unknown to us as regards its contents) Jupiter's circle of action extends to 4+48=52. Then follows Saturn in 4+96=100 parts—*an admirable proportion*." The following table will show more clearly this "admirable proportion." It will be seen from the last line, which represents the observed planetary distances, that, although not exact, there is a very close approximation :—

	M.	V.	E.	M.	Ast.	Jup.	Sat.	Ur.	Nep.
	4	4	4	4	4	4	4	4	4
	0	3	6	12	24	48	96	192	384
Dis. by Bode's law..	4	7	10	16	28	52	100	196	388
Obs. Plan. Dis.......	3·9	7·3	10	15·2	27·4	52	95·4	192	

Since, however, the credit of this theory is attributable to Titius, if not to his predecessor Kepler, the honor of making it practically useful in detecting the existence of a planet in the space referred to is shared by the celebrated Baron de Zach of Gotha and Professor Bode of Berlin, the former of whom is said to have commenced a computation of its orbit as early as 1784. Under the Baron's auspices, a congress of astronomers met a Lilienthal in 1800, for the purpose of agreeing to some plan of hunting down this unknown body whose presence was deemed almost certain. Twenty-four observers were present. They agreed to divide the heavens into as many zones, giving one to each astronomer. They commenced their labours on the first day of the first year of the present century, and scarcely had they got their instruments adjusted, before Piazzi of Palermo, one of their number, noticed a small star of about the 7th or 8th magnitude, which was not registered in his catalogue. The next night, to his inexpressible delight, he found that it had changed its position; that, in fact, it was a planet. Baron de Zach heard of the discovery with great joy, commenced a computation of its orbit, the result of which satisfied him, of course, of the correctness of his favourite law of relative distance. To this youthful member of the system Piazzi gave the name of Ceres. To it has since been added the large number of 32, making in all, up to the present time, a group composed of 33 members, all of which, with the date of

their discovery, the names of the parties by whom they were first observed, and the places at which the observations were made, will be seen by the following table :—

PLANETOIDS DISCOVERED UP TO OCTOBER, 1854.

No.	Names.	Date.	Discoverer.	Place.
1	Ceres.	1801, January 1.	Piazzi.	Palermo.
2	Pallas.	1802, March 28.	Olbers.	Bremen.
3	Juno.	1804, September 1.	Harding.	Lilienthal.
4	Vesta.	1807, March 29.	Olbers.	Bremen.
5	Astræa.	1845, December 8.	Hencke.	Dresden.
6	Hebe.	1847, July 1.	"	"
7	Iris.	1847, August 13.	Hind.	London.
8	Flora.	1847, October 18.	"	" [Ireland.
9	Metis.	1848, April 25.	Graham.	Markree castle
10	Hygeia.	1849, April 12.	Gasparis.	Naples.
11	Parthenope.	1850, May 11.	"	"
12	Victoria.	1850, September 13.	Hind.	London.
13	Egeria.	1850, November 2.	Gasparis.	Naples.
14	Irene.	1851, May 19.	Hind.	London.
15	Eunomia.	1851, July 29.	Gasparis.	Naples.
16	Psyche.	1852, March 17.	"	"
17	Thetis.	1852, April 17.	Luther.	Bilk, Germany
18	Melpomene.	1852, June 25.	Hind.	London.
19	Fortuna.	1852, August 22.	"	"
20	Massilia.	1852, September 19.	Chacornac.	Marseilles.
21	Lutetia.	1852, November 15.	Goldschmidt.	Paris.
22	Calliope.	1852, November 16.	Hind.	London.
23	Thalia.	1852, December 15.	"	"
24	Themis.	1853, April 5.	Gasparis.	Naples.
25	Phocæa.	1853, April 6.	Chacornac.	Marseilles.
26	Proserpina.	1853, May 5.	Luther.	Bilk.
27	Euterpe.	1853, November 8.	Hind.	London.
28	Bellona.	1854, March 1.	Luther.	Bilk.
29	Amphitrite.	1854, March 2.	Albert Marth.	London.
30	Urania.	1854, July 22.	Hind.	"
31	Euphrosyne.	1854, September 1.	Jas. Ferguson.	Washington.
32	Pomona.	1854, October 28.	Goldschmidt.	Paris.
33	Polymnia.	1854, October 28.	Chacornac.	"

It is worthy of remark that a large proportion of the discoverers were but amateur astronomers. Dr. Olbers was a practitioner in medicine. M. Hermann Goldschmidt is an historical painter, who has resided for several years in Paris. He discovered Lutetia with a small ordinary telescope which he kept in his room. Messrs. Hencke and Luther are both amateurs.

It is also worthy of remark that, in several instances, the same asteroid has been discovered by more astronomers than one, quite independently of each other. It was so in the case of Metis, Massilia, Amphitrite, and others. It will also be seen that Mr. Hind's name occurs ten times as a discoverer. Mr. Hind is attached to the private observatory of Geo. Bishop, Esq., which was erected in 1836 in the Regent's Park, London. M. de Gasparis has discovered seven; M. Luther three. Only one has been discovered by an American.

I also subjoin a table for which I am indebted to Professor Loomis, exhibiting the longitude of perihelion, longitude of ascending node, inclination of orbit, eccentricity, mean distance from the sun, and periods in days of each of the asteroids whose elements have as yet been accurately determined :—

ELEMENTS OF THE ASTEROIDS.

No.	Name.	Distance from Sun.	Time of revolution in days.	Eccentricity.	Inclination of orbit.	Long. of ascending node.	Long. of perihelion.
1	Ceres	2·766	1680	0·079	11°	81°	150°
2	Pallas	2·770	1683	·239	35	173	122
3	Juno	2·668	1592	·256	13	171	54
4	Vesta	2·361	1325	·090	7	103	251
5	Astræa	2·577	1511	·189	5	141	136
6	Hebe	2·425	1379	·202	15	139	15
7	Iris	2·386	1347	·231	5	260	41
8	Flora	2·201	1193	·157	6	110	33
9	Metis	2·386	1346	·123	6	68	72
10	Hygeia	3·149	2041	·101	4	288	227
11	Parthenope	2·448	1399	·098	5	125	317
12	Clio	2·335	1303	·045	8	235	302
13	Egeria	2·577	1512	·085	17	43	120
14	Irene	2·584	1518	·169	9	187	179
15	Eunomia	2·643	1570	·188	12	294	28
16	Psyche	2·933	1835	·131	3	151	11
17	Thetis	2·484	1430	·131	6	125	259
18	Melpomene	2·294	1269	·215	10	150	16
19	Fortuna	2·444	1396	·159	2	211	31
20	Massilia	2·401	1359	·145	1	207	99
21	Lutetia	2·434	1387	·162	3	80	327
22	Calliope	2·912	1815	·104	14	67	59
23	Thalia	2·645	1571	·240	10	68	123
24	Themis	3·144	2037	·123	1	36	135
25	Phocæa	2·401	1359	·253	22	214	303
26	Proserpina	2·588	1522	·069	4	46	175
27	Euterpe	2·348	1314	·171	2	94	87
28	Bellona	2·781	1694	·163	9	145	120
29	Amphitrite	2·546	1484	·069	6	356	54
30	Urania	2·359	1322	·155	2	308	27
31	Euphrosyne	2·948	1849	·076	23	33	352
32	Pomona						
33	Polymnia						

ORIGIN OF THE ASTEROIDS.

On the discovery of Pallas in 1802, and after Gauss's calculations had proved that the orbits of Ceres and Pallas were at nearly the same mean distance from the Sun, and that they had nearly the same periods, Dr. Olbers conceived the idea that they were fragments of a large original planet, which had been broken up either by internal explosion or by collision with a comet, and suggested the probability that the labors of future observers might be rewarded by the discovery of other fragments, perhaps even smaller than those already found, revolving in similar orbits. In support of this conjecture, it was "urged that in the case of such a catastrophe, as was involved in the supposition, the fragments, according to the established laws of physics, would necessarily continue to revolve in orbits, not differing much in their mean distances from that of the original planet; that the obliquities of the orbits to each other and to that of the original planet might be subject to a wider limit; that the eccentricities might also have exceptional magnitudes; and, finally, that such bodies might be expected to have magnitudes so indefinitely minute as to be out of all analogy or comparison, not only with the primary planet, but even with the smallest of the secondary ones." The conditions which rendered the planetoids exceptional being consistent with this ingenious hypothesis of Dr. Olbers, it was generally regarded as at least a probable truth, and scientific men at once commenced to speculate on the character of the original planet, its history, its size, and its fate. Lagrange, for instance, instituted

an investigation to ascertain the amount of force necessary to burst a planet and separate its fragments. "The possibility of determining by calculation, even approximately, the epoch of such a cosmical event as the destruction of a planet," Humboldt considers "more than doubtful, from the complication produced by the already large number of the 'fragments' known, the peculiar retrogression of the apsides and motion of the nodes." This has not, however, deterred ingenious men from investigations respecting this "destroyed planet." Mr. Daniel Kirkwood, of Delaware College, United States, has even ventured to restore from the fragments which remain the primitive planet, in the same manner as others have attempted to restore the animals of the primitive earth. He finds for it a diameter greater than Mars (of more than 4320 geographical miles), and gives it the slowest rotation of all the principal planets and a length of day of 57 hours and a half. Another American, Professor Alexander, concludes, from the mean of two results separately obtained, that the equatorial diameter of the supposed parent planet was about 50,000 miles, while its polar diameter was scarcely greater than the thickness of the bright rings of Saturn.

As illustrative of the mode in which this supposed original planet may have been broken up, Mr. Nasmyth, in a paper read before the British Association in 1853, referred to the case of the well known toy called "Prince Rupert's drop," viz.: "A drop of glass which has been let fall while in a semi-fluid state into water, by which the surface of the glass drop is caused to cool and consolidate so rapidly that the subsequent consolidation and contraction of the interior mass induces such a high degree of tension between it and the exterior crust, that the slightest vibration is sufficient to overcome the cohesion of the external crust, and by so letting free the state of tension to cause the glass drop to fly into thousands of fragments." Applying this to the case of the parent planet of the asteroids, he says: "It may have consisted of such materials as that by the rapid passing of its surface from the original molten condition to that of solidification, while the yet fluid or semi-fluid went on contracting by the comparatively gradual escape of its heat into space through the solid crust, a state of tension may thereby have been induced, such as that in the 'Rupert's drop,' and that the crust may have at last given way with such violence as to cause the fragments to part company, and to pass off, whirling into orbits, slightly varying from each other, according to corresponding variations in the condition of each at the instant of rupture."

With the progress of discovery, opinions change. The great inclination of the orbit of Pallas had long presented a difficulty to those who supported the hypothesis of Olbers. The numerous additions made yearly to the sum of the small planets, have confirmed some astronomers in the opinion that the planetoids were formed in the same manner, and according to the same laws, as the other heavenly bodies—that no alteration, in fact, had occurred in the primitive system of the universe. While examining, during last winter, the opinions of astronomers in regard to the small cosmical bodies denominated meteors or falling stars, I had a strong impression that the asteroids would be found to be similar to these in origin and character, as well as destiny. I was afterwards confirmed in this opinion by a paper written by Le Verrier, and published in *Silliman's Journal* for July, 1854, in which he overturns the views of Olbers regarding the perturbation of the orbits of the planets, caused by their mutual attraction; and after a thorough investigation of the secular variations of the elements of the orbits, establishes, amongst others, the following propositions:—"1. The eccentricities of the orbits of the known asteroids can suffer only very small changes as the effect of perturbation. These eccentricities, which are now quite large, have then always been and will always remain large. 2. The same is true of the inclination of their orbits. So that the amount of eccentricity and inclination answers to the primitive conditions of the formation of the group."

Amongst the latest hypotheses on the subject of the asteroids, I may state the opinion of the author of that remarkable book, "The Plurality of Worlds," who, it is pretty well known, is Professor Whewell.* "The near coincidence," says he, "of the orbits of the small bodies between Mars and Jupiter, has suggested to astronomers the conjecture that they have resulted from the explosion of a larger body, and from its fracture into fragments. Perhaps the general phenomena of the universe suggest, rather, the notion of a collapse of portions of sidereal matter, than of a sudden disruption and dispersion of any portion of it; and these small bodies may be the results of some imperfectly effected concentration of the elements of our system, which, if it had gone on more completely and regularly, might have produced another planet like Mars or Venus. Perhaps they are only the larger masses among a great number of smaller ones, resulting from such a process; and it is very conceivable that the meteoric stones are other results of the like process—*bits of planets* which have failed in the making, and lost their way, till arrested by the resistance of the Earth's atmosphere. Their great eccentricity, great deviation from the zodiacal path, and their great number all fall in with the supposition that there are in the solar system a vast multitude of such *abnormal planetoidal lumps.*"

In a paper on "New Theories of the Universe," prepared for presentation to the British Association at the meeting last year, and with a copy of which I have been favored, the author, James Bedford, Ph.D., of New Brighton, advances some startling doctrines, amongst which is the following regarding these bodies:—"The asteroids," he believes, "were projected in one mass from the sun, as were all the other primary planets; but, like a snowball thrown into the air when not sufficiently compacted, the mass separated where they are found; hence they all move in the same direction as the other planets, which could not be accounted for, if, as some terrifyingly suppose, they were originally a world that burst asunder. Verily, a planet once sufficiently condensed, cooled down from its igneous state to become a habitable globe, will *never* burst."

The following are the most remarkable peculiarities of this group of planets:—

1. They are exceedingly small, the largest being at the utmost only 145 geographical miles in diameter. Le Verrier concludes that the sum total of the matter constituting those situated between the mean distances of 2° 20′ and 3° 16′ cannot exceed about *one-fourth of the mass of the Earth.*

2. They occupy a distinct zone in which they circulate, and thus clearly indicate the existence of some peculiar family relationship.

3. The inclinations of their orbits range from zero up to 35°; and the eccentricities from near zero up to more than one

* Since the above was written, it has been found that Mr. J. S. Smith, of Balliol College, Oxford, not Dr. Whewell, is the author of the "Plurality of Worlds."

quarter; those orbits having great eccentricity, have also generally great inclination to the ecliptic.

4. Their orbits so interlace, that, if represented materially as hoops, the orbit of one would support the orbits of all the others; in other words, they all hang together in such a manner, that the whole group may be replaced by any given one; "thus affording," says D'Arrest, "the strongest evidence of the intimate connection that exists amongst them."

Indian Tribes of Canada.

(*Read before the Canadian Institute, February* 10*th*, 1855.)

By Wm. Bleasdell, M.A., Trenton, C.W.

Of the first inhabitants of the Province, and especially of the Indian tribes of Western Canada, little is known previous to the settlement of the banks of the St. Lawrence by the French. Apparently too little attention has been paid in times gone by to the preservation of those Indian traditions, which, in the absence of written records and architectural monuments, are the only materials by which an idea of the shadowy past of a nation or a race can be attained.

On the discovery of the River St. Lawrence and the colonization of the lower section of the Province, the north bank of the river, between Quebec and the Ottawa, was occupied by the Algonquin or Adirondac race of Indians. In close alliance with these were the Wyandots or Quatoghies, a tribe of a different stock to the Algonquin—it being a kindred one to the Iroquois. Between the Wyandots and the other Iroquois tribes there existed a deadly feud. On the arrival of Jacques Cartier, the discoverer of the St. Lawrence in 1534, the Wyandots occupied the lower part of the river on the south bank, as far as the Island of Anticosti and the Bay of Chaleurs.

With the Algonquin tribes and the Wyandots the Iroquois Indians waged an incessant warfare, and eventually drove them from the valley of the St. Lawrence—a few only of each tribe remaining there. The bulk of the Algonquins drew off to the north-west, near Lake Nipissing; the Ottawas of the Algonquin stock, who at that time lived also on the banks of the St. Lawrence, migrated to the great chain of the Manitoulin Islands in Lake Huron, and the Wyandots fled to the shores of the same lake, to which they communicated the name they had received from the French, being called by them Hurons.

At the same period came some others of the tribes of the Algonquin stock, and occupied the country between Lakes Huron and Superior and the river Ottawa. The chief and most prominent amongst these are the Chippewas or Ojibwas. These Indians, the most numerous and the most widely spread, were of the true Algonquin race. These are believed, at a comparatively recent period, to have been sub-divided into smaller tribes or divisions, bearing some local name, and differing scarcely in any perceptible degree in language, looks, and customs. Of these the Mississauguas, or Mississaguas, the Indian occupants of the northern shores of Lakes Ontario and Erie, and the Bay of Quinté, were situated most to the south. Their language is pure Algonquin; and they were designated Mississauguas from the fact of their inhabiting the banks of a river of that name, on the north shore of Lake Huron, between La Cloche and Point Tessalon. Spreading southwards from thence, in 1653, they are stated to have extended to the tract of country lying between the Niagara and Genesee rivers, south of Lake Ontario. This could not have continued for any extended period, for they must thus have been intruding on the territory especially claimed by the Iroquois confederacy, with whom the Mississauguas, in common with the other Algonquin races, were embroiled in incessant warfare.

And many a spot by lake and river, on headlands and on islands, bore witness in those days to the fell conflict, and re-echoed the startling war-whoop, traces of which struggles in many places remain to this day. In the great Indian and Colonial struggle which raged with such violence during the seventeenth century, and in which the Algonquin tribes and the Wyandots were ranged on one side, supporting the French dominion in North America, and the Five Nations of the Iroquois confederacy were opposed to it, the Eries, a tribe of the same stock as the latter, and inhabiting the banks of the Niagara river and the south shore of Lake Erie, occupied a neutral position, and hence were designated by the French, the Neutral Nation. They eventually offended their kindred of the Five Nations, which led to a war of extermination, that ended in the year 1653. Since that event not a remnant of them has been heard of.

During this period, and a long time previously to this, the Canadian frontier and the shores of Lake Ontario and the Bay of Quinté more especially became the great battle-field of the Indians of the rival races of the Algonquin and Iroquois confederacies, and it formed a sort of debatable ground, which continued more or less until the final conquest of Canada, and the overthrow of the French dominion in North America. In 1672 Fort Frontenac, at the mouth of the river Catararqui, at the outlet of Lake Ontario, was built by that able and energetic Governor of Canada, Louis de Buade, Comte de Frontenac; and this post became a centre of action, from whence the influence of the French was extended in military, trading, and missionary operations to the surrounding country. Thus, in the course of time, Fort Frontenac became the general resort and rendezvous of the Northern and Western tribes of Indians, and the centre of their trade with the French. From all directions they repaired thither, even, it is said, from the distance of 1000 miles, bearing with them the produce of the chase, the rich spoils of the hunter and trapper, to exchange for European goods. From Fort Frontenac, le Salle and de Tonti, with the Recollect Fathers, Louis Hennipen, Membre, and Watteax, sailed westward towards the Mississippi in 1679, and first saw and described the Falls of Niagara.

The former occupants of Western Canada were, as we have seen, then chiefly of the Mississaugua tribe, and these, with others of the Chippewa race and Algonquin stock, and their associate tribe, the Wyandots or Hurons, of the Iroquois stock, may be said to have been those who occupied the Province previously and subsequent to its first colonization by the French, and indeed to its subjection to British rule and enterprise. The Five Nations of the Iroquois confederacy, viz., the Mohawks, Cayugas, Oneidas, Onondagas, and Senecas, having their territory originally comprehended in the present State of New York, though they have had the majority of their tribes settled within the Province since the war of the American Revolution, yet they cannot be considered as the aborigines of Canada, but as refugee Loyalist Indians. Their confederacy was increased by the addition of the Tuscaroras in 1712, and thus they formed the Six Nations. There is, indeed, a tradition that these Iroquois came from beyond the great Lakes, and subdued or exterminated the inhabitants of the country south of them, but there is an uncertainty respecting this, and it proves nothing respecting their origin, for the time might have been when the ancestors of these passed from the south to the country north of the Lakes.

Schoolcraft subdivides the Northern American Indians into the four following groups:—

Iroquois.	*Algonquin.*	*Dacotah.*	*Appalachian.*
1. Mohawks.	1. Chippewas.	1. Omakes.	1. Chickasaws.
2. Oneidas.	2. Ottewas.	2. Oloes.	2. Cherokees.
3. Onondagas.	3. Western Algonquins, chiefly of Lepanee sub-type.	3. Winnebagoes.	
4. Cayugas.		4. Iowas.	
5. Senecas.		5. Dacotahs or Sioux.	
6. Tuscaroras.			
7. St. Regis tribe.	4. Menomeries.	6. Quapaws.	
8. Wyandots.			
9. Senecas and Shawnees.			

The traditions associated with spots where the relics of warfare are found, betoken the fell struggle between the Red men of the rival races, wherever existing, are worthy of preservation as records of men and a state of things which have now almost passed away.

Coleoptera Collected in Canada.

By William Couper, Toronto.

[*For authorities and synonyms, see Melsheimer's Catalogue of the Coleoptera of the United States, published by the Smithsonian Institution, Washington.*]

CICINDELA

SEXGUTTATA.—*Mels. Cat.* Green, polished, finely punctured. On each elytron there are three white marginal spots, and a small white spot near the centre; antennæ brown at the tips; lip yellow. Toronto; common. Length 0·5.

PURPUREA.—*Mels. Cat.* Purple-green; margin of elytra golden green: with a white flexuous stripe on each, and a single white dot behind each stripe—white fasciæ at the apex; thorax, top of head, and legs villous; lip white. Toronto, not common. Length 0·65.

DUODECIMGUTTATA.—*Mels. Cat.* Purple red; elytra with a round white dot on the front part: a broad white flexuous stripe in the centre, and behind each stripe another round white dot—white fasciæ at the apex. Rare. Length 0·55.

VULGARIS.—*Mels. Cat.* Ground color dull, elytra with two white oblique stripes—the first commences on the front angles, covers a small space on the margin, and extends nearly to the suture; the second from the margin half across the elytra, thence downwards, terminating in an upward curvature, near the suture: two white curved spots at the apex. Toronto, common. Length 0·65.

PUNCTULATA.—*Mels. Cat.* Body narrow, dark purple, polished; elytra with a longitudinal row of light blue punctures, each side of the suture: sometimes they fade; body beneath green; legs hairy, long, and slender. Lake Simcoe. Length 0·45. (Note 1.)

GALERITA

JANUS.—*Mels. Cat.* Thorax red or tile color; elytra azure, finely striate; antennæ villous, black in the middle, the first joint red and long; head dark brown, nearly as long as the thorax; eyes shining black; legs colour of thorax. Toronto, very rare—having taken but two specimens in four summers' collecting. Linné's *Systema Naturæ* says it inhabits Carolina. Probably lat. 44° is its most northern range of distribution. Length 0·75.

BRACHINUS*

VIRIDIPENNIS.—*Mels. Cat.* Head, thorax, legs, and antennæ red; elytra truncate, azure, with elevated lines near the suture. Toronto peninsula; London, C.W. Common. L. 0·4.

CORDICOLLIS.—*Mels. Cat.* Head, thorax, legs, and antennæ red; elytra blue, with a green tinge. Small. Don valley. L. 0·3.

CASNONIA

PENSYLVANICA.—*Mels. Cat.* Head rhomboid, black; thorax long, cylindrical, polished black; elytra truncate, reddish brown, a black fascia on the centre, thus ⌒, which encompasses the margin to the apex, in form something like the letter D. Peninsula, opposite Toronto. July. L. 0·26.

AGONUM

8-PUNCTATUM.—*Mels. Cat.* Dark green bronze; thorax polished bronze; elytra with four punctures on each, longitudinally arranged, and near the suture. Toronto,—on the margin of rivers; rare. Length 0·3. (Note 2.)

CUPRIPENNE.—*Mels. Cat.* Head, thorax, and elytra rich metallic polish. This beautiful carab is common throughout the Province. Size of *A. 8-punct.* L. 0·3.

CHLŒNIUS

SERICEUS.—*Mels. Cat.* Thorax polished green; elytra glossy green. When held in the fingers it disgorges a fetid fluid, which produces a colour on them similar to that from the juice of a fresh butternut. Don valley and Peninsula; common under stones, &c. Length 0·6.

TRICOLOR.—*Mels. Cat.* Head golden, polished; antennæ and legs ferruginous; thorax gold bronze, polished, and finely punctured, with a slight groove on the disc, and a curved impression on each side of its posterior edges; elytra dull blue, striate—the striæ finely grooved and densely covered with fine silky hairs. Common on the Peninsula. Length 0·5.

CALOSOMA

SCRUTATOR.—*Mels. Cat.* Elytra striate, green; thorax azure: sometimes violet, with a reflected margin; edge of elytra golden.

A large and brilliant beetle, but rarely taken in this neighbourhood. I found two dead specimens in July, 1854, in drift on the peninsula. Probably they came down the Niagara river, and had been from thence blown across the lake by a south wind. Length 1·2. (Note 3.)

CALIDUM.—Black; elytra with raised crenate striæ, and marked with a triple row of indented gold or copper dots; there are four or five copper dots near the scutel; posterior part of thorax deep, the margin elevated, with a fine longitudinal groove on the disc; antennæ reddish at the tips. Taken by Richardson on the borders of Mackenzie and Slave rivers, in lat. 58°—65° N. Length 1·0.

FRIGIDUM.—Kirby, N. Z. 4, 19. Black, polished; thorax margined and finely punctured (not elevated, as in *Calidum*), with a fine longitudinal groove in the centre; elytra striate—the striæ finely punctured; three rows of indented polished dots on each; no large punctures near the scutel. One living specimen was taken on the Peninsula in July, 1854. L. 0·9.

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* Our American species of Brachinus are of various sizes, but resemble each other in form and color. The characters by which they are distinguished are very slight. They "possess the singular power of emitting with great force a highly volatile and corrosive liquid, so as to produce a slight explosion."—*Lec.*

ELAPHRUS

RUSCARIUS.—*Mels. Cat.* On the margin of Lake Ontario and at Sturgeon Bay. Small.

OMOPHRON

AMERICANUM.—*Mels. Cat.* Common in April and May, under stones, &c., on the Peninsula, opposite Toronto.

STAPHYLINUS

VILLOSUS.—*Mels. Cat.* Head and thorax black and polished, the front margin of the latter villous; elytra black, polished, with a grey transverse band, on which are three or four small black punctures longitudinally arranged; scutel large, indented; lateral parts of abdomen grey; legs black. Toronto, common. Taken by Mr. Richardson at Lake Winipeg, in lat. 49° N.

VULPINUS.—*Mels. Cat.* Head, thorax, elytra, legs, and tip of abdomen, red. Toronto, common.

CINGULATUS.—*Mels. Cat.* Head, thorax, and elytra villous, and covered with irregular impressions; scutel round, black; two rings at the tip of abdomen and joints of rings underneath of a beautiful yellow satin color. Toronto. Not common.

CRYPTOBIUM

BICOLOR.—*Mels. Cat.* Head black; antennæ, thorax, elytra, tip of abdomen, and legs, red. Margin of Don river common.

CATOGENUS

RUFUS.—*Mels. Cat.* Head, thorax, elytra, and legs red. Found in crevices under the fresh bark of forest trees. The species of this group are very flat—a form well suited to their natural habits.

LUCANUS

DAMA.—*Mels. Cat.* Jaws (♂) long, curved like a sickle, with a small inside tooth towards the point; head broad, smooth; elytra deep mahogany brown, smooth, polished. Length about 1½ inch, exclusive of jaws.

Jaws (♀) toothed, but much shorter; head narrow. August, on various old trees.

PELIDNOTA

PUNCTATA.—*Mels. Cat.* Oblong-oval; elytra tile color or dull brownish yellow, with three distinct black spots on each; body beneath and legs of a deep bronzed green color. About 1 inch in length. Found at Niagara on the cultivated grape vine in July and August. Flies by day.

AREODA

LANIGERA.—*Mels. Cat.* Broad oval; head, thorax, and elytra lemon-yellow color, glittering like burnished gold; under side of body copper-colored, thickly covered with whitish wool; legs brownish-yellow or brassy, shaded with green. In gardens, chiefly on pear trees. Lat. 44° N.

OMALOPLIA

SERICEA.—*Mels. Cat.* The ground color of this beautiful little lamellicorn is very deep chestnut brown, on which there is a satin tinge reflecting various hues. (Note 4.)

OSMODERMA—GYMNODUS

SCABER.—*Mels. Cat.* Head punctured, concave on the top, with the edge of vizor turned up in ♂; thorax nearly round, wider than long; elytra purplish black, with a coppery lustre, the outer edges entire. Head in ♀ nearly flat, vizor not raised; elytra deeply and irregularly punctured; body beneath smooth; larger than ♂. Found in the hollows of forest trees, especially basswood, in which the larvæ form egg-shaped cocoons. In July; nocturnal.

EREMICOLA.—*Mels. Cat.* Elytra of a deep mahogany-brown color, smooth, and highly polished. Larger than the above, of similar habits, but not so abundant.

CETONIA

INDA.—*Mels. Cat.* Head dark brown, covered with short greenish yellow hairs; thorax triangular, dark copper brown, also covered with greenish yellow hairs; elytra light yellow brown, with pearly and metallic tints, and numerous irregular black spots; scutel large; underside of body black and very hairy. "In April and May it may be seen around the borders of woods and in dry open fields, flying just above the grass, with a loud humming noise, and is often mistaken for a humble bee. The second brood in September is fresher and brighter and found on the golden rod, on corn stalks, on trunks of the locust tree, also on ripe peaches. They have a disagreeable smell."—*Harris.* (Note 5.)

STENURUS—DICERCA

DIVARICATA.—*Mels. Cat.* Head and thorax copper-colored and finely punctured; elytra brassy and densely covered with irregular impressed lines and punctures—spread apart at the apex and obtuse; scutel round concave; breast grooved; body beneath rich copper color.

♂ has a tooth on the under side of shanks of the middle pair of legs. June, July, and August.

LURIDA.—*Mels. Cat.* Antennæ brassy; head, thorax, elytra, body beneath, and legs densely covered with punctures—of a lurid color above—rich copper beneath; thorax has irregular elevated polished spots; elytra with elevated narrow lines arranged in twos and threes.

CHALCOPHORA—BUPRESTIS

VIRGINICA.—*Mels. Cat.* Oblong; reflecting copper color; head deeply indented on top; three elevated black polished lines on thorax; elytra roughly punctured, with two small square spots—on each side towards the margin one elevated smooth line, and a second line near the suture. Some short hairs occupy the grooves on elytra; body beneath sprinkled with short whitish hairs. About 1 inch in length. Appears in May and June on pine trees, the leaves of which they devour.

CHRYSOBOTHRIS—ODONTOMUS

FEMORATA.—*Mels. Cat.* Greenish black above, with a brassy polish; elytra: one impressed spot on each; anterior femora toothed beneath. In June they bask on trees, &c., and are not easily captured, being very active in elevating their elytra for flight.

DENTIPES.—*Mels. Cat.* Thorax finely punctured, and two elevated lines; elytra punctured, with irregular smooth elevated lines, interrupted and divided by impressed spots; body flat, oblong oval, rough like shagreen above, copper color beneath; anterior femora armed with a little tooth. Length about ½ inch. Habits same as above. June. (Note 6.)

ALAUS

OCULATUS.—*Mels. Cat.* Antennæ serrate; thorax black, oblong square, on which there are two oval velvet-like spots encircled by a white ring: the edges are sprinkled with a whitish powder; elytra black, striate, and sprinkled with numerous white spots, which are easily rubbed off. Measures from 1¼ to 1¾ inch in length. In decayed timber, July. Not common.

ELATER—Ampedus

apicatus.—*Mels. Cat.* Antennæ black; head and thorax black, finely punctured, and covered with short yellow hairs; elytra pale, with rows of fine punctures longitudinally arranged: the suture and apex black.

lugubris.—*Mels. Cat.* Head and thorax black, finely punctured, the latter covered with short yellow hairs; elytra red, with rows of fine punctures: black at the apex. (Note 7.)

ARRHENODES

septentrionis.—*Mels. Cat.* Snout nearly straight, equal in thickness throughout; thorax oval, mahogany-brown, smooth and highly polished; elytra striate polished, and darker than thorax, with yellow spots, two of which are near ahe apex.

♂ with jaws, the inside of each is armed with a small tooth. In June and July, on the trunks of white oak. (Note 8.)

ORTHOSOMA

cylindricum.—*Mels. Cat.* Head black; antennæ short, black, compressed; thorax short, three-toothed; elytra compressed, nearly equal in breadth throughout, of a chesnut color, with three slightly elevated lines on each. Common on pine trees about the middle of July. Length 1¼ to 1½ inch.

ARHOPALUS

fulminans.—*Mels. Cat.* Thorax globular, with three black spots, the middle one larger; elytra with angular waved white fasciæ, thus ≈; antennæ short, ash colored; scutel black. Toronto; very rare.

EUDERCES

picipes.—*Mels. Cat.* Antennæ as long as body; thorax oval, polished, and finely striate on top, narrow behind, with a few yellow hairs each side; elytra in front with a black velvet like spot, on which a yellow band forms an arch. On wild parsnip and other flowers. Small.

CLYTUS

speciosus.—Say, Am. Ent. 3, t. 53. *Harr. Ins. p. 84. "Head yellow; antennæ and eyes reddish black; thorax black, with two transverse yellow spots on each side; elytra for about two-thirds of their length are black, the remaining one-third yellow,—a yellow spot on each shoulder, —a broad yellow curved band or arch, of which the scutel forms the key-stone, on base of elytra: behind this, a zigzag yellow band, forming the letter W across the middle; another yellow band arching backwards, and on the yellow one-third—a curved band and spot of black; legs yellow; under side of body reddish-yellow, variegated with brown. It is the largest known species of Clytus, being from nine-tenths to eleven-tenths of an inch in length, and three-tenths in breadth. On the trunks of maple trees in July and August."* Rare.

MONOHAMMUS

titillator.—*Mels. Cat.* Head vertical or perpendicular; antennæ very long; thorax spinous; elytra punctured, with several small black and grey spots. Common. Length 1 to 1¼ inch.

scutellatus.—*Mels. Cat.* Atennæ twice as long as body; thorax black, polished and densely punctured, with a spine each side; elytra densely punctured—the punctures largest in front; scutel white; body beneath and legs black, polished. Taken by Richardson at Fort Simpson, on the Mackenzie river, in lat. 62° N. Toronto; not common.

TETRAOPES

tornator.—*Mels. Cat.* Head, thorax, and elytra red; antennæ black, with a raised black spot at the base; thorax, with a protuberance each side, and four black spots on top; six black spots on elytra; scutel black; body beneath black. Don valley, on the *Asclepias syriaca*. Rare.

SAPERDA

puncticollis.—*Mels. Cat.* Jaws, eyes, and base of antennæ black; head yellow: a round black spot on the front, and a black conical spot on the top; thorax yellow: with an oblong black spot on each side, and four black spots on the top; elytra black, widely margined with yellow; scutel yellow, slightly raised; suture yellow, and connects at the apex with the extorior margin. Montreal; rare.

vestita.—*Mels. Cat.* Densely clothed with short yellowish ash-colored hairs; elytra slightly depressed on top, with a few black spots obliquely placed about the middle. Toronto.

tripunctata—*Mels. Cat.* Front of head and antennæ dark brown; eyes black, circular, prominent; thorax yellow: with a black spot on each side of the breast, and two elevated black dots on the top, a third dot near the scutel; in some specimens the middle dots on thorax are wanting; "elytra black, coarsely punctured in rows on the top, and irregularly on the sides and tips, each of which is slightly notched, and ends with two little points."—*Harris*. The form of this beetle is slender, cylinndrical. On raspberry. Toronto, not common.

COMPOSIDEA

tridentata.—Oliv. Ins. 4, 28 Black; densely covered with ash colored pubescence; eyes black, oblong; a rusty-red stripe and two black spots on each side of the thorax; united to a rusty-red stripe on the margin of the elytra, are three oblique teeth of the same color: anterior tooth short and hooked: posterior one encompasses the suture to the apex. L. ½ inch.

DESMOCERUS

palliatus.—*Mels. Cat.* Head narrow; third and three following joints of antennæ abruptly thickened at the extremity, giving them a knotty appearance; thorax conical, uneven,—with little sharp projecting points at each side of the base; fore part of the elytra dull orange color, the other half deep violet or Prussian blue; some specimens are glossed with green. In the centre of elytra the two colors are oblique—each being indented. In June and July on the common elder (*Sambucus Canadensis*). Toronto and Sault Ste. Marie, not common.

(*To be continued.*)

ADDENDA: by Henry Croft.

Note 1.	Cic. purpurea...Probably Kirby's Var. D.		
	" ...Var. G.	Peninsula,	rare.
	" ...type.	Peninsula,	rare.
	Cic. punctulata	Toronto.	
	Cic. hirticollis	"	
2.	Ag. 8-punctatum	Gardens,	not uncommon.
3.	Cal. scrutator	Toronto,	Darlington.
	Cychrus viduus	Toronto,	rare.
4.	Phyllophaga quercina	common,	May beetle.
	Omaloplia vespertina	Toronto,	not uncommon.
	Macrodactylus subspinosus	"	common.
	Dichelonycha virescens	"	"
	" testacea	"	"

5. Cetonia fulgida	Humber,	rare.
Trichius rotundicollis	Gardens,	common.
6. Buprestis chrysostigma	Toronto,	common.
,, lineata	,,	,,
7. Melanotus cinereus	,,	,,
Ludius appressifrons	,,	,,
Ctenicerus Kendalli	,,	,,
Elater obesus	,,	,,
8. Rhynchænus Nenuphar	Plum weevil.	
Bruchus pisi	Pea weevil.	
Balaninus nasicus	rare.	
Hylobius Pales	common.	
Attelabus analis	,,	
,, bipustulatus	rare.	
Rhynchœnus Strobi	common.	
Hylurgus terebrans	,,	
Tomicus exesus?	,,	
9. Arhopalus nobilis	Toronto,	very rare.
,, Robiniæ	Niagara,	common.
Elaphidion mucronatum	Toronto,	rare.
Tylonotus bimaculatus	,,	,,
Oberea mandarina?	,,	,,
Clytus erythrocephalus	,,	not common.
,, ruricola	,,	common.
,, colonus	,,	,,
Cyrtophorus verrucosus	,,	,,
Callidium atennatum	,,	,,
,, violaceum	,,	,,
,, russicum	,,	,,
Criocephalus agrestis	,,	,,
Tetropium cinnamopterum	,,	rare.
Saperda calcarata	,,	very rare.
Graphisurus fasciatus	,,	common.
Liopus adspersus	,,	rare.
,, maculatus	,,	,,
Necydalis mellitus	,,	,,
Rhagium lineatum	,,	,,
Centrodera decolorata	,,	,,
Typocerus fugax	,,	,,
Evodinus monticola	,,	common.
Strangalia Quagga	,,	rare.
,, elegans	,,	,,
,, emarginata	,,	rare, Mr. Ibbetson.
Leptura Canadensis	,,	not common.
,, proxima	,,	,,
,, biforis	,,	,,
,, sphæricollis	,,	,,
,, vittata	,,	common.
,, erythroptera	,,	rare, Mr. Ibbetson.

Mr. Couper having commenced a catalogue of his insects, it is greatly to be hoped that he may continue it, as few persons in Toronto are better qualified for the task, on account of his already tolerably extensive cabinet and his zeal in collecting.

The above list, which may form a sort of appendix to Mr. Couper's catalogue, has been very hurriedly made up from those insects in my collection which are at present labelled. By far the larger portion remain undetermined.

The St. Clair Flats and Lake Navigation.

A Committee of the Buffalo Board of Trade, appointed to inquire into the amount of losses sustained by owners of vessels which have been detained on the St. Clair Flats during the last season of navigation, have recently made a report, from which we gather the following facts:

The number of steamers engaged in the carrying trade of the Upper Lakes, and passing the St. Clair Flats, having a total tonnage of	6,880 tons.
Number of propellers, forty-four, of	21,789 "
Total steam tonnage	28,649 "

The vessels have paid for lighterage, including expenses of same during time detained, and for damages by collisions while aground on the Flats, the sum of $208,000.

There are also of sail vessels engaged in same trade:

Thirty-two barques of	12,234 tons.
Eighty-four brigs of	21,756 "
One hundred and ninety-eight schooners of	48,323 "
Total sail	82,324 "

These vessels, the Committee estimate, have paid out during the season of 1854, for;

Towing and lighterage	$168,686 56
Time detained, 5,566 days	220,640 00
Damage for repairs by collisions, &c.	62,800 00
Total sail damage	$452,126 56
Total steam	208,000 00
Total damage	$660,126 56

Emigration during 1854.

The number of passengers who arrived at Quebec in 1854, was 53,183, of whom 52,365 were steerage. The number which left Europe was 51,965 steerage, and 811 cabin; 83 were born on the passage, and 847 died at sea, and 46 at quarantine. 52,326 were landed from the ships; 857 came from the lower Provinces. This return shows an increase on 1853 of 16,484, or nearly 45 per cent., the immigration being larger than in any previous year except 1847. The total immigration since 1829 amounted to 825,187, averaging 31,738 per annum.

	1853.	1854.
There sailed from England	9,585	18,175
" " Ireland	14,417	16,168
" " Scotland	4,145	6,446
" " Germany	2,400	5,688
" " Norway	5,056	5,749
" " N. Brunswick	496	857
Total	36,699	53,183

Of those coming from England, 13,471, or nearly three-fourths, were from Liverpool. Of these 2,739 were natives of England, 4,268 of Ireland, 727 of Scotland, 4,613 of Germany, 199 of Norway, 231 of Holland, 641 of Sweden, and 58 of the United States and Canada. 295 Germans sailed from Hull, and 255 from Dublin. The nativity of the whole is shown in the following table:—

	1853.	1854.
Natives of England	3,928	7,353
" " Ireland	18,972	20,269
" " Scotland	4,913	7,186
" " Germany	3,135	11,034
" " Norway	5,133	5,849
" " Sweden	96	910
" " Holland	32	236
" " Switzerland	——	7
" " United States	——	25
" " Canada	——	33
	36,203	52,859

The foreign immigrants were 18,078 against 1,489 in 1853. The increase of English and Scotch was 5,698, and of Irish 1,297.

Tabular Statement of the Mean Results of Meteorological Observations, made at St. Martin, Isle Jesus, C. E., for the Year 1854, by Charles Smallwood, M.D.

(COMPILED FOR THE CANADIAN JOURNAL.)

MONTHS.	Mean of Barometer in inches.	Mean Temp. of Air.	Mean of Humidity.	Amount of Evaporation in Inches.	Depth of Snow in Inches.	Depth of Rain in Inches.	Days of Snow.	Days of Rain.	Snowing in Hours.	Raining in Hours.	Most Prevalent Winds.	Least Prevalent Winds.	Mean of Maximum Velocity.	Mean of Minimum Velocity.	Thunder on Days.	Auroras on Nights.	Range of Barometer	Range of Thermom.
1854.		°		*					H. M.	H. M.								°
January	29·516	10·92	·843	......	17·98	1·067	12	2	75·55	6·10	N E b E	S	13·82	0·12	...	4	1·519	78·8
February	·520	12·20	·825	......	23·96	0·150	13	3	79·50	2·00	N E b E	E	14·77	0·00	...	5	1·168	71·7
March	·024	25·84	·840	......	28·61	0·910	12	5	63·25	3·10	N E b E	S S E	23·82	0·58	...	6	1·076	60·4
April	·440	37·75	·835	1·86	4·03	7·886	3	7	5.50	49·10	N E b E	E	11·79	0·03	1	5	0·991	52·2
May	·731	57·17	·723	4·13	......	3·418	...	8	......	32·00	W S W	S	23·98	0·03	...	5	0·708	60·7
June	·814	63·80	·780	2·95	......	8·384	...	10	......	48·50	E N E	N	23·03	0·00	4	2	0·536	46·6
July	·916	76·20	·709	5·12	......	0·174	...	5	......	1·50	S W b W	N	5·94	0·00	2	7	0·565	48·5
August	·910	68·31	·714	4·70	......	2·265	...	7	......	7·45	N W b N	E	17·58	0·00	3	3	0·582	48·2
September	30·001	58·01	·781	3·11	......	6·167	...	11	......	15·16	W	S	11·08	0·00	4	8	0·847	64·2
October	29·949	48·40	·874	1·49	3·10	4·844	...	11	6·10	33·55	W S W	N	14·92	0·00	...	2	1·162	55·5
November	·764	32·99	·878	......	1·10	5·130	3	10	7·45	29·40	W N W	N	15·41	0·95	...	0	1·524	50·6
December	·540	7.35	·850	......	18·67	0·110	10	1	44 31	4·30	N E b E	E	22·25	0·00	...	3	1·534	78·1
WINTER.																		
December	29·456	16·57	·759	......	13·13	0·316	7	1	51·16	2·40	......	......	22·61	0·05	...	3	0·950	62·5
January	·516	10·92	·843	......	17·98	1·067	12	2	75·55	6·10	N E b E	S	13·82	0·12	...	4	1·519	78·8
February	·520	12·20	·825	......	23·96	0·150	13	3	79·50	2·00	......	......	14·77	0·00	...	5	1·168	71·7
Quarterly Means	29·497	13·26	·809	......	55·07	1·533	32	6	206·21	10·50	......	......	17·06	0·12	...	12	1·212	70.6
SPRING.																		
March	29·024	25·84	·840	......	28·61	0·910	12	5	63·25	3·10	......	......	23·82	0·58	...	6	1·076	60·4
April	·440	37·75	·835	1·86	4·03	7·886	3	7	5·50	49·10	N E b E	S S E	11 79	0·03	1	5	0·991	52·2
May	·731	57·17	·723	4·13	......	3·418	...	8	......	32·00	......	......	23·98	0·03	...	5	0·708	60.7
Quarterly Means	29·398	40·25	·799	5·99	32·64	12·214	15	20	68·75	84·20	......	......	19·86	0·21	1	16	0·923	57·4
SUMMER.																		
June	29·814	63·80	·780	2·95	......	8·384	...	10	......	48·50	......	......	23·03	0·00	4	2	0·536	46·6
July	·916	76·20	·709	5·12	......	0·174	...	5	......	1·50	S W b W	E	5·94	0·00	2	7	.0·565	48·5
August	·910	68·31	·714	4·70	......	2·265	...	7	......	7·45	......	......	17·58	0·00	3	3	0·582	48·2
Quarterly Means	29·880	69·43	·734	12.77	......	10·823	...	22	......	57·45	......	......	15·51	0·00	9	12	0·561	47·4
AUTUMN.																		
September	30·001	58·01	·781	3·11	......	6·167	...	11	......	15·16	......	......	11·08	0·00	4	8	0·847	64·2
October	29·949	48·40	·874	1·49	......	4·844	...	11	6·10	33·55	W S W	S	14·92	0·00	...	2	1·162	55·5
November	·764	32·99	·878	......	1.10	5·130	3	10	7·45	29·40	......	......	15·41	0·95	...	0	1·524	50·6
Quarterly Means	29·904	46·46	·844	4·60	1·10	16·141	3	32	13·55	78·11	......	......	13·80	0·31	4	10	1.179	56·7
Yearly Means, 1854	29·677	41·57	·804	23·36	97·45	40·505	53	80	222·6	231·16	N E b E	S S E	19·53	0·16	14	50	1·017	59·95

* The amount of Evaporation is only observed from April to October, inclusive, owing to Frosty Weather:

On the Clearness of the Atmosphere in Oroomiah, in Persia.

BY REV. T. D. STODDARD.*

Presuming that a letter written to you from ancient Media, and relating to your favorite science, will not be unacceptable, I shall make no apology for the liberty I take in addressing you. My home is in Northern Persia, where I have resided for the last nine years, as an American Missionary to the Nestorian Christians. To give you an idea of our geographical position, I have noted, above, our latitude and approximate longitude. As I wish also to give you a glance at the physical features of this region, let me invite you to come with me upon the flat, terraced roof of my house, where I am sure you will be delighted with the scene before you. Standing at an elevation of more than a mile above the ocean, and a thousand feet above the adjoining country, you may look down upon one of the lovliest and most fertile plains in all the East. Extending for forty miles in length, and from twelve to fifteen in breadth, the district of Oroomiah smiles with hundreds of villages, is verdant with thousands of orchards, and rows of poplars, willows and sycamores by the water-courses, and in the early summer waves with innumerable fields of golden grain. Here the peach, the nectarine, the apricot, the quince, the cherry, the pear, the apple, and the vine, flourish in luxuriance, and give the appearance of a variegated forest. Beyond the plain, you see the lake of Oroomiah, reflecting the purest azure, and studded over with numerous islands, while further on rise distant and lofty mountains, their outlines projected on the cloudless Italian sky, and forming a beautiful contrast with the plain before you. The city of Oroomiah, about six miles distant, which is so embosomed in trees as almost to be hidden from view, is the probable birth-place of Zoroaster; and the mounds which are so conspicuous in different parts of the plain, and which are formed entirely of ashes with a scanty soil upon them, are supposed to be the places where the sacred fire was ever kept burning, and the Persian priests bowed in adoration to the rising sun.

The temperature of this elevated region is very uniform, and the greater part of the year very delightful. During the months of June, July, August, September, and sometimes October, there is little rain, and the sky is rarely overcast. Indeed, I may say that often for weeks together not a cloud is to be seen. As a specimen of the climate in summer, I send accompanying this my meteorological register for the month of August last. The observations were taken at our house on Mt. Seir, but do not differ essentially from those taken on the plain at the same season, except that the thermometer is here a few degrees lower, and the air somewhat drier, especially at night.

No one has ever travelled in this country, without being surprised at the distinctness with which distant objects are to be seen. Mountains fifty, sixty, and even a hundred miles off, are projected with great sharpness of outline on the blue sky; and the snow peak of Ararat, the venerable father of mountains, is just as bright and beautiful when two hundred miles distant, as when we stand near its base. This wonderful transparency of the atmosphere frequently deceives the inexperienced traveller; and the clump of trees indicating a village, which seems to rise only two or three miles before him, he will be often as many hours in reaching.

In this connection, you will be interested to know that the apparent convergence of the sun's rays, at a point diametrically opposite its disc, which, if I mistake not, Sir D. Brewster speaks of as a very rare phenomenon, is here so common that not a week passes in summer when the whole sky at sunset is not striped with ribbons, very much like meridians on an artificial globe.

But it is after nightfall that our sky appears in its highest brilliancy and beauty. Though accustomed to watch the heavens in different parts of the world, I have never seen anything like the splendour of a Persian summer evening. It is not too much to say that, were it not for the interference of the moon, we should have seventy-five nights in the three summer months, superior for purposes of observation to the very finest nights which favour the astronomer in the New World. When I first came here, I brought with me a six-feet Newtonian telescope, of five inches aperture, of my own manufacture; and though the mirrors have since been much tarnished, and the instrument otherwise injured, its performance is incomparably superior to what it was in America. Venus sometimes shines with a light so dazzling that at a distance of *thirteen feet* from the window I have distinguished the hands of a watch, and even the letters of a book.

Some few months since, having met with the statement that the satellites of Jupiter had been seen without a glass, by a traveller on Mt. Etna, it occurred to me that I was in the most favourable circumstances possible for testing the power of the unassisted eye, and I determined at once to make some experiments on the subject. My attention was, of course, first turned to Jupiter, but for a considerable time, with no success. It was always so bright, and shot out so many rays, that it seemed quite impossible to detect any of its moons, even at their greatest elongation from the planet. I varied the experiment in several ways, by looking through the tube of a small telescope, from which the lenses had been taken, and also by placing my eye near the corner of a building, so as to cut off the most brilliant rays of the planet, and yet leave the view unobstructed to the right hand or the left; but in neither cases could I find any satellite. Some time after, I was sitting on the terrace as daylight was fading into darkness, and thought I would watch Jupiter from its first distinct appearance, till it shone out in its full splendour. This time I was exceedingly gratified, just as stars of the first and second magnitude were beginning to appear, to see two extremely faint points of light near the planet, which I felt sure were satelites. On pointing my telescope towards them, my first impressions were confirmed, and I almost leaped for joy at my success. Since that night, I have many times, at the same hour of the evening had a similar view of these telescopic objects, and think I can not be mistaken as to the fact of their visibility. I must, however, add that none of my associates, who at my request have attended to the subjet, are *sure* that they detect them, though the most sharp-sighted individual feels some confidence that he can do so. As these friends, however, are not practical observers, their failure to see the satellites does not shake at all my belief that I have seen them myself.

The time during which these satellites are visible is hardly more than ten minutes. The planet itself soon becomes so bright that they are lost in its rays. I will not stop to discuss the question, in itself a most interesting one, why they are visible at all, when stars of the third and fourth magnitudes are not distinguishable, but merely give you the facts in the case, knowing that you will reason on them much better than I can. Both the fixed stars and the planets shine here with a beautifully steady light, and there is very little twinkling when they are forty degrees above the horizon.

Having come to a satisfactory conclusion about the satellites of Jupiter, I turned next to Saturn. This planet rose so late in the night that I had not seen it while watching Jupiter, and I was curious to know whether any traces of a ring could be detected by the naked eye. To my surprise and delight, the moment I fixed my eye steadily upon it, the elongation was very apparent, not like the satellites of Jupiter, at first suspected, guessed at, and then clearly discernible, but such a view as was most convincing, and made me wonder that I had never made the discovery before. I can only account for it from the fact that, though I have looked at the planet here with the telescope many times, I have never scrutinized it carefully with the naked eye. Several of my associates, whose attention I have since called to the planet, at once told me in which direction the longer axis of the ring lay, and that too without any previous knowledge of its position, or acquaintance with each other's opinion. This is very satisfactory to me, as independent collateral testimony.

I have somewhere seen it stated, that in ancient works on astronomy, written long before the discovery of the telescope, Saturn is represented as of an oblong shape, and that it has puzzled astronomers much to account for it. Am I not correct in this impression ? and, if so, is it not possible that here, on these elevated and ancient plains, where shepherds thousands of years ago watched their flocks by night, and studied the wonders of the glorious canopy over their heads, I have found a solution of the question ?

After examining Saturn, I turned to Venus. The most I could determine with my naked eye, was, that it shot out rays unequally, and appeared not to be round; but, on taking a dark glass, of just the right opacity, I saw the planet as a very minute, but beautifully defined, crescent. To guard against deception, I turned the glass in different ways, and used different glasses, and always with the same pleasing result. It may be that Venus can be seen thus in England, and elsewhere, but I have never heard of the experiment being tried.

Let me say here, that I find the naked eye superior for these purposes to a telescope formed of spectacle glasses, of six or eight magnifying power. This is not, perhaps, very wonderful, considering that

* From a letter addressed to Sir John F. W. Herschel, dated Oroomiah, Persia, N. Lat. 37° 28′ 18″, Long. E. from Greenwich 45° 1′, November 23d, 1852.

in direct vision both eyes are used, without the straining of any one of the muscles around them, and without spherical or chromatic aberration, or the interposition of a dense medium.

As I am an entire stranger, and at the same time am desirous of having these statements make their full impression on your mind, it is proper for me to say that I was formerly for several years a pupil of professor Olmsted of Yale College, New Haven, and have since been admitted to his special friendship; and that I was associated for some time in observations with young Mason, whose early death you have spoken of as a loss to the astronomical world. And though, no doubt, many persons have more accurate habits of observation than myself, a practice of fifteen years has done much to train my eye for researches like these.

You will also bear in mind the great dryness of our atmosphere, indicated by the register, as well as our great elevation. Capt. Jacob, (Proceedings of the Edinb. Royal Society, vol. ii, No. 36,) in speaking of the extinction of light in the atmosphere, says: "The loss of light in passing from the zenith through a homogeneous atmosphere of 5·2 miles will be ·303. I was much astonished at first discovering that the air had so great absorbent powers, and many ideas are suggested by the fact."

My letter is already becoming tedious, but I will venture to trespass on your patience further, by naming a few test-objects, which would enable you the better to compare the advantages of our position with your own.

1. δ Cephei. This I have looked at repeatedly with my naked eye, and though I cannot be *sure* that I have seen it double, I put it down, in astronomical language, as "strongly suspected."

2. The two small stars in the neighborhood of the pole-star, and in the general direction, of γ Cephei (thus . P ·.) are seen distinctly, and almost every night, as a single point of light.

3. 4 and 5 ϵ Lyræ are very beautiful and well defined. When lying on my back, the view of these stars, as they have passed near the zenith, has been very similar to that I have often had of Castor in a good telescopo. There being *no dew* here, it is almost the universal custom for the peoplo to sleep upon the terraced roofs, which gives them an opportunity, if so disposed, to gaze upon the blue vault above them.

4. α Libræ is seen as two stars in any ordinary state of the atmosphere, as readily as α Capricorni would be in America.

5. Mizar and Alcor in Ursa Major. On looking at these any favorablo night, two faint stars, which must be telescopic in England, are distinctly seen. They appear something like this (· ·80 ζ· ·).

As I am absorbed in other and pressing labors, which allow me to devote only an occasional thought to astronomical pursuits, and as, besides, I am not furnished with any first rate instruments, allow me to suggest the great desirableness of some experienced observer's coming here to avail himself of this magnificent climate. One who should spend even a limited period in Oroomiah, might safely promise himself a good, and perhaps a very rich, harvest of astronomical discovery.

Tho averages of the meteorological register for August, alluded to above, wero as follows:

Barometer reduced

Sunrise.	2 P. M.	10 P. M.
24·246	24·247	24·235.

General average..........24·242
Barometer highest.......24·417
" lowest......... ·097

Difference............ ·320

Fahrenheit's Thermometer.

Sunrise.	2 P. M.	10 P. M.
67°·4	79°·45	71°·37

General average of the three observations, 72°·44.

Hygrometer—wet bulb.

Sunrise.	2 P. M.	10 P. M.
54°·82	60°·43	55°·37

General average from the above, 56°·87

Average differenco of Hygrometer and Thermometer, 15°.87.
" " " " " " at 2 P. M., 19°·02.
Greatest change of Thermometer in 24 hours, 18°.

N. B. The daily observations differ but little from the weekly average. One day follows another with great uniformity.

Letter on the Smithsonion Institution.

BY PROFESSOR AGASSIZ.

Addressed to the Honourable Charles W. Upham.

Dear Sir,—Every scientific man in this country has been watching with intense interest the proceedings of the Smithsonian Institution ever since its foundation, satisfied, as all must be, that upon its prosperity the progress of science in America in a very great measure depends. The controversies which have been lately carried on respecting the management of the Institution have increased the solicitude of its friends with regard to its future prospects in a degree which can hardly be realized by those who are not immediately connected with the cause of science.

As a foreigner, who has enjoyed but for a few years the privilege of adding his small share to support the powerful impulse which scientific investigations have lately received from those who are the native representatives of science in America, I have thus far abstained from taking any part in this discussion, for fear of being charged with meddling with matters in which I have no concern. There is, however, one feature of the institution itself, which may, I trust, justify the step I have taken in addresing you upon this subject as the chairman of the committee elected by the House of Representatives to investigate the proceedings of that establishment.

With the exception of a few indirect allusions, I do not see that any reference is made in the discussion now going on to the indisputable fact that the Smithsonian Institution is *not an American institution.* It was originated by the liberality of a high-minded English gentleman, intrusting his fortune to the United States to found in Washington an institution *to increase and diffuse knowledge among men.* America, in accepting the trust, has obtained the exclusive management of the most important and the most richly endowed scientific institution in the world; but it is at the same time responsible to the scientific world at large for the successful prosecution of the object of the trust, which is to *increase* and *diffuse* knowledge among men.

Were it not for this universal character of the institution, I would not think it becoming in me to offer any suggestion with regard to it. As it is, I feel a double interest in its prosperity—in the first place, as an institution designed to foster the progress of science at large, and without reference to nationalities or local interests, and next, as more immediately connected with the advancement of science in the country of my adoption.

The votaries of science may differ in their views about the best means of advancing science, according to the progress they have themselves made in its prosecution; but there is one standard of appreciation which cannot fail to guide rightly those who would form a candid opinion about it. I mean the lives of those who have most extensively contributed in enlarging the boundaries of knowledge.

There are two individuals who may, without qualification, be considered tho most prominent scientific men of the nineteenth century—Cuvier and Humboldt. By what means have they given such powerful impulse to science? How have they succeeded not only in increasing the amount of knowledge of their age, but also in founding new branches of science? It is by their own publications and by aiding in the publications of others; by making large collections of specimens and other scientific apparatus, and not by the accumulation of large libraries. Humboldt never owned a book, *not even a copy of his own works*, as I know from his own lips. "He was too poor," he once said to me, "to secure a copy of them;" and all the works he receives constantly from his scientific friends are distributed by him to needy students.

Again, there is hardly a scientific man living on the continent of Europe, who is not indebted to him for some recommendations in the proper quarter for assistance in the publication of their works. I mention more particularly these details about Humboldt, because he is happily still among tho living, and his testimony may be asked in a matter of such deep importance to the real progress of science. But the samo is equally true of the part Cuvier took in his day in promoting science. All his efforts were constantly turned towards increasing the collection of the *Jardin des Plantes*, and supporting the publication of original researches, giving himself the example of the most untiring activity in publishing his own.

In this connection, I ought not to omit mentioning a circumstance to which the United States owes the legacy of Smithson, which I happen

accidentally to know, and which is much to the point, in reference to the controversy concerning the management of the Smithsonian Institution.

Smithson had already made his will, and left his fortune to the Royal Society of London, when certain scientific papers were offered to that learned body for publication. Notwithstanding his efforts to have them published in their transactions, they were refused; upon which he changed his will and made his bequest to the United States. It would be easy to collect in London more minute information upon this occurreuce, and should it appear desirable, I think I could put the committee in the way of learning all the circumstances. Nothing seems to me to indicate more plainly what were the testator's views respecting the best means of promoting science than this fact.

I will not deny the great importance of libraries, and no one has felt more keenly the want of an extensive scientific library than I have since I have been in the United States; but, after all, libraries are only tools of a secondary value to those who are really endowed by nature with the power of making original researches, and thus increasing knowledge among men. And though the absence or deficiency of libraries is nowbere so deeply felt as in America, the application of the funds of the Smithsonian Institution to the formation of a library, *beyond the requirements of the daily progress of science*, would only be, iu my humble opinion a perversion of the real object of the trust, inasmuch as it would tend to secure facilities only to the comparatively small number of American students who may have the time and means to visit Washington when they wish to consult a library. Such an application of the funds would in fact lessen the ability of the Smithsonian Institution to accomplish its great object, (which is declared by its founder to be the increase and diffusion of knowledge among men,) to the full extent to which they may be spent towards increasing unduly the library.

Moreover, American students have a just claim upon their own country for such local facilities as the accumulation of books affords.

If I am allowed, in conclusion, to state my personal impression respecting the mauagement of the Institution thus far, I would only express my concurrence with the plan of active operations adopted by the regents, which has led to the publication of a series of volumes, equal in scientific value to any production of the same kind issued by learned societies anywhere.

The distribution of the Smithsonian Contributions to Knowledge has already carried the name of the Institution to all parts of the civilized world, and conveyed with them such evidence of the intellectual activity of America as challenges everywhere admiration: a result which could hardly be obtained by applying the resources of the Institution to other purposes.

On Peat and other Vegetable Charcoal and some of its Uses.

BY WILLIAM LONGMAID.*

The subject to which I propose to direct your attention this evening is Charcoal, and some of its uses. The materials forming the earth's surface have been described by geologists and chemists, as consisting of comparatively a few simple substances; and their distribution and uses instructively and beautifully illustrate the power, the wisdom, and the goodness of the Almighty Creator, and furnish unlimited evidence of design.

Of undecomposed substances, probably there is no one that plays more important and varied parts than carbon; if we contemplate the diamend, that beautifies the diadem of royalty, the still more beautiful electric light, or the vast deposits of coal, so extensively distributed in this favoured island, carbon must be regarded as an agent of primary importance.

If we extend our researches to organic beings, we find that with the exception of the framework of animals and the shells of crustacea, carbon forms a moiety of the solid materials of all organic beings, whether animal or vegetable; the beautiful flowers and foliage that adorn the earth, the colours that deck the plumage of the feathered tribes, no less than the tints that clothe the inhabitants of the teeming oceans and rivers, the fragrant perfumes wafted on the gentle breeze, all owe their existence in part to carbon; nay, even some of the solid rocks that form the framework of the great globe itself, are compounded in part of this substance.

However varied in form, and widely-diffused carbon may be in nature, in its countless combinations it is no less useful, in the arts, sciences, and manufactures; indeed, we trace its effects everywhere, in fact, if carbon were to be withdrawn from the earth, organic existence would cease, and the physical condition of the earth itself would be changed.

It may not be amiss, then, to devote a few minutes this evening to the consideration of carbon, in some of its forms and uses, as it is found in the arts and manufactures, particularly under the term vegetable charcoal, the produce of wood and peat.

Charcoal produced from vegetable matter is carbon isolated from the constituents of water, with which it is always combined in organic substances; there are several methods ordinarily employed for this purpose; one in considerable use, is most rude, and no doubt of great antiquity; it consists in digging a pit in the earth, and piling up pieces of wood or peat in large heaps, which are covered with clods of earth in such a manner that the pile may be ignited at the base; when the fire is well kindled, more clods are placed over the pile, in order to prevent the too free access of atmospheric air, and which is eventually excluded; the heap is allowed to stand from one to five or six weeks, the length of time depending on the size of the operation. Another method is much practised in some parts of the Continent, and consists of a furnace somewhat in the form of a kiln, with apparatus to exclude the air; it is filled with the material ignited at the base, and the operation proceeds much in the same manner as before described. Modern science has provided a more perfect operation in destructive distillation in retorts, whereby the volatile products are condensed and are of great practical utility.

In the first method I have described, about 18lbs. of charcoal are obtained from every 100lbs of dry wood; this is considered a fair yield; the other products are mostly lost. In the second method more tar and pitch are obtained with the same quantity of charcoal. But by the more elaborate process of distillation, naphtha, acetic acid, ammonia, and other matters are obtained, together with about 20 to 25 lbs. of charcoal for every hundred pounds of wood.

There is yet a more recent process for the manufacture of vegetable charcoal, for which, jointly with my son, I have obtained letters patent; this process consists in steeping vegetable matter in dilute sulphuric acid, and drying it at a low temperature, whereby we obtain from 40lbs. to 65lbs. of charcoal for every 100lbs. of dry material submitted to the operation.

I presume the experiment I am about to make with sulphuric acid and sugar, has been exhibited in every lecture room in the United Kingdom; this demonstrates the principle of the new mode of manufacturing charcoal, the sulphuric acid has a greater affinity for the elements of water than carbon, and the latter is isolated. We have found that every description of vegetable matter to which we have applied this mode of treatment, has exhibited the same phenomena.

The chemical action that takes place is well understood, and presents no novelty; but the application of this principle to useful purposes, on alarge scale, I believe has not before been accomplished; this expcriment will demonstrate the nature of the process; this is sawdust of pine timber and has been steeped in sulphuric acid of the strength of 3 degrees of Twaddles hydrometer. I will now place it on this plate, and apply a lamp underneath—we shall soon see the result.

Perhaps it is impossible to over-estimate the importance of charcoal. England is possessed of vast deposits of mineral coal, which enables our manufacturers to produce iron at a cost that bids defiance to all competition. The deposits of coal and iron-stone may be regarded as the foundation of all our greatness as a nation, but whilst the iron is producd in quantities of which the mind can scarcely conceive an adequate idea, and whilst it is of a quality fitted for an endless variety of purposes, for which strength and cheapness are the prime qualifications, it is totally unfit for the manufacture of steel. This circumstance renders this country dependent on foreign countries, chiefly Russia and Sweden, for iron of superior quality. The sole cause of the superiority of foreign iron, is the fact that charcoal is the fuel employed for smelting the ore.

The coke used by the British smelter contains a sensitive amount of sulphur, chiefly in combination with iron, and exists in the coal in the form of iron pyrites; it is found practically impossible, in the great operations of iron smelting, to separate it at a cost that would render it practicable.

On the other hand, charcoal is all but absolutely free from sulphur, and it exists in vegetable matter in the condition of sulphuric acid, and combined with alkali, thus forming a neutral salt, which combines

* Journal Society of Arts.

with the earthy matters of the ore, and thus forms an ingredient of the slag. If from any unforeseen circumstance our supplies of foreign iron should cease, our steel and cutlery manufacturers would be driven to great extremity, and this branch of British industry, of world-wide reputation, would be in danger of considerable derangement.

There are other branches of manufacture dependent on charcoal for their success:—gunpowder and tin-plates; it is also largely used by founders and engineers, and more recently it has been used as a deodoriser, disinfecter, and decoloriser, and also as a manure.

A cursory glance at the position and limited surface of England, with its dense and increasing population, will be sufficient to convince us that space cannot be spared for the growth of timber for fuel; this will be still more evident, if we consider for a moment the consumption of coals in the metropolitan district for the year 1854, which amounted to 3,400,000 tons. The quantity of wood necessary to produce charcoal of equal heating power, would exceed 400,000,000 cubic feet. If we add to the quantity required for London, the quantity required for the consumption of the country and for exportation, we shall find that the entire surface of Great Britain would be inadequate to grow timber sufficient to manufacture charcoal of equal heating power. Whilst this is undoubtedly the case, and with an ever-increasing demand for fuel, attention has been directed to the *bogs* of the United Kingdom, as offering an exhaustless mass of organic matter, ready to be converted by the hand of science into fuel of first-rate quality, eminently suited for most of our manufacturing and domestic purposes.

The extent of bog land in Ireland alone exceeds 3,000,000 acres in surface, in many localities ascertained to be of a depth of 30 feet and upwards.

It is well known that peat charcoal, when employed as fuel for smelting iron, and tempering edge tools, &c., has produced articles of surpassing excellence; it is largely used on the Continent in smelting works, and for domestic purposes.

Peat is vegetable matter undergoing partial decomposition, and probably its formation commenced at a very remote period of the world's history. It is found in natural basins, formed by the inequalities of the earth's surface, wherein the water is dammed up and prevented from flowing into adjacent streams and rivers. In these lakes, vegetable matter has accumulated and is undergoing various changes, and final decomposition. In the earlier deposits it is characterized by a nearly homogeneous structure; but the later and more superficial deposits present a less decomposed, and compacted character, and has the general appearance of an entangled or felted structure, composed of partially decomposed moss and grass, and not unfrequently of shrubs and trees; the moss and grass have the appearance of gradual and successive decomposition at the roots, whilst they continue a vigorous vegetation at the surface.

The entire mass, both of the more compact and the less solid peat, is composed chiefly of ligneous matter, and may be considered as analagous to woody fibre; its quality, however, is frequently affected by the special circumstances of locality. The best samples we have met with have contained, when dried, about 70 to 75 per cent. of carbon, but other samples were contaminated with earthy matters to the extent of 5 to 10 per cent., and we have found some samples of peat charcoal yielding 94 per cent. of fuel.

The attention of the scientific world is now fully awakened to the importance of rendering this vast source of wealth available; not that the coal fields of Great Britain are likely soon to be exhausted, notwithstanding the millions upon millions of tons raised annually, but as a matter of economy in the race of the arts, manufactures, and civilization, it is of first importance to get the greatest possible amount of good at the lowest possible cost. What, then, is the present state of the fuel market? The demand for coke and coals for locomotives, for marine engines, for exportation and other purposes, is so enormous, that the price has been raised to such an extent as to threaten the destruction of extensive industrial operations carried on on the Tyne and in other coal districts. Immense quantities of coke are being sent to the extremities of Great Britian and Ireland, for working the locomotives of the railways, whilst many of the lines traverse vast tracts of bog, capable of being made into fuel, equal in value to coke, and, in such localities, at a third of its cost.

There is another remarkable feature which may be noticed. Ironstone is at this moment being raised in the immediate vicinity of deposits of peat, but in the absence of any economical carbonising process, to render it fit for smelting iron, the ore has to be sent to smelting works, at a considerable charge for carriage. It is a remarkable fact that iron-stone is found constantly occurring in the vicinity of deposits of peat, and when once this treasure is brought fairly to bear, we may anticipate the production of iron of the finest quality.

It may be truly affirmed of Ireland that she contains within her borders all the raw material, except cheapness, to make her a worthy competitor of Great Britain as a manufacturing country; and if once a cheap and practical method be devised of rendering the peat into good charcoal, I can see no end to the prosperity of that country,—abounding, as it does, in rich deposits of iron, copper, lead, and sulphur ores in unlimited quantities, together with rock salt, clay, limestone, slates and granite, having also fine lakes and rivers, the rude materials that form the foundation of a nation's greatness as a manufacturing people. In addition to the mineral deposits, Ireland possesses in her hardy sons the bone and muscle and the energy necessary to raise her to the first rank as a manufacturing nation; and I do not despair of seeing the peat-bog in course of transformation into charcoal, and her idle population become industrious and prosperous manufacturers. I venture to predict, that when the manufacturing capabilities of that country, so rich in native, and at present unappreciated materials, become fully known, capital will flow readily to her aid. But as long as Irish manufacturers have to draw their chief supplies of coal and coke from England and Scotland, her manufactures must languish, and so long will her vast mineral treasures remain undeveloped, and her population be without profitable employment.

The question may arise,—Why is the iron produced by vegetable charcoal of better quality than that by mineral coke? The answer is obvious: iron has an intense affinity for sulphur, and mineral coal contains iron pyrites, a portion of the sulphur of which remains with and injures the texture of the metal smelted by its agency, and renders it unfit for the manufacture of steel, as it is impossible, except at an enormous cost, when once the sulphur has combined with the iron, to make a perfect separation.

Vegetable charcoal also contains some sulphur, but in all cases in a neutral form, combined with potash, soda, or other alkaline re-agents, in this condition it readily combines with the earthy matters of the ore, and forms an ingredient of the slag The peat charcoal we propose to manufacture also contains sulphur, chiefly in the neutral state, as alkaline salts, but a small portion also remains as free acid. In smelting operations the alkaline sulphates combine with the earthy matters of the ore, forming slag, and the free sulphuric acid is decomposed.—One atom of the oxygen of the acid combines with an atom of carbon, forming carbonic oxide, and liberating the remaining oxygen and the sulphur as sulphurous acid; thus all the sulphur of the free sulphuric acid is evolved into the atmosphere.

In pit coal the sulphur exists in varying quantities, from one to fifteen per cent. When it exists in larger quantity than two or three per cent. it renders the coal unfit for many manufacturing purposes.

There is another quality of fuel of great importance, its heating power. The following table is an extract from Dr. Ure's work, and may be regarded as the mean results of numerous experiments made by that gentleman. It gives the quantity of water raised from the freezing to the boiling point, and the quantity of water of the temperature of 212°, evaporated by the combustion of one pound of fuel in each case:—

	Pounds of water raised from 32 to 212 degrees.	Water at 212° evaporated.
	lbs.	
Perfectly dry wood - - -	35	6·36
Wood in its ordinary state	26	4·72
Do. charcoal - - - -	73	13·27
Pit-coal - - - - - -	60	10·90
Coke - - - - - - -	65	11·81
Peat - - - - - - -	30	5·45
Peat charcoal - - - - -	64	11·63

It will be seen from the above table that wood charcoal stands first in heating power, coke second, and peat charcoal within 1·3 per cent. equal to coke.

Charcoal has also the peculiar faculty of absorbing watery vapour and gases to an extraordiuary extent. Professor Liebig states the result of experiments conducted by Saussure, that one volume of charcoal in 24 to 36 hours absorbed 90 volumes of ammoniacal gas, 65 sulphurous acid, and 55 of sulphuretted hydrogen. It also absorbs nitrogen and many other gases. This property of charcoal has of late been turned to practical account, as it has been used as a disinfecter, and deodoriser, some interesting particulars of which will be found in a paper read to this Society by Dr. Stenhouse, in the early part of last

year.* Since that period experiments have been made by Mr. Barford, at Bartholomew's Hospital. The particulars were published in the *Lancet* a few weeks since. The writer, after describing the substances possessing the property of deodorising and disinfecting, and the chemical action on which they respectively depend, and also pointing out their several defects, adds, that they are all open to serious objections; but the one which practically will be found the most effectual, I believe, has received the least patronage. This is charcoal, a body whose disinfecting powers have long been known, but its mode of application has been quite neglected. A most perfect trial has been made in the dissecting rooms of St. Bartholomew's Hospital, which must abound in noxious gases and putrescent odours. On thoroughly heating the charcoal and placing it in shallow vessels about the rooms, it acted so promptly, that in ten minutes not the least diffused smell could be detected. So quick and effectual was its action, that arrangements have been made for its constant use. As a purifier of hospital wards, both civil and military, it might be applied with great advantage, saving patients from the unpleasant smells and effluvia from gangrenous wounds; thus the patient himself and those in adjacent beds, would not be subjected to the influence of putrescent odours. All these the charcoal would effectually absorb. Charcoal is more efficacious than any other disinfectant when applied in the manner described, absorbing gases of every kind. It does not require the presence of any other substance to assist its action, but without stint or scruple collects noxious vapours from every source, not disguising, but condensing and oxydising the most offensive gases and poisonous effluvia, converting them into simple, inert, stable compounds. It is easy of application, and is economical, comes within the reach of the poorest, and can be safely placed in the hands of the most ignorant, thus combining advantages not possessed by any other disinfectant.

Mr. Barford also described a process for purifying the charcoal, so as to renew its powers, but this need not be practised, for the charcoal after being used in the hospitals, is more valuable as a manure, by reason of the gases it has absorbed; thus its use need not entail any expense on such establishments. This brings us to the consideration of charcoal as a manure, for which purpose it is likely to become an important agent, especially from the circumstance of its possessing such intense affinity for nitrogenous gases and aqueous vapour.

Professor Liebig states that peat and spent bark are most difficult forms of organic matter to deal with as manure; that peaty matter remains for years exposed to the influence of air and water without undergoing change, and in this state yields little or no nutriment to plants. Recent experience has, however, shown that when organic matters, such as peat and spent tan, are converted into charcoal, they become exceedingly valuable as vehicles for the transmission of water, nitrogenous compounds, carbonic acid, &c., to the plants, first separating these matters from the atmosphere, and again yielding them up when required.

The mode of applying charcoal as manure is simple; it should be ground to a coarse powder, and then strewn over farm yards, manure heaps, stables, cow-houses, pig-styes, cess-pools, or placed in manure tanks, urinals, &c.

It is suitable for being applied, also, without mixture by the drill or broad cast, in the proportion of 4 to 7 cwt. per acre, to all green and corn crops, and will be found a valuable addition to most soils, especially those which are composed of clay.

Perhaps I may be permitted to make a short digression, for the purpose of introducing to your notice another preparation of peat; this is peat manure produced by steeping the peat fresh from the bog in a solution of caustic alkali; it is then dried and ground.

Contrary to the general opinion of writers on agricultural chemistry, that the atmosphere and water are the sources from whence vegetables derive their carbon, I entertain the opinion, that they would at all times take up a large proportion of their carbon by the roots, whenever it is presented in soluble compounds, such as organic matters dissolved by means of alkalies, in which condition it has been found, by actual experiment, that growing plants do take up and assimilate the carbon of such compounds, when they are applied in a suitable form.

In the substance I have now the honour of submitting to your notice, a very large portion of the inert peaty matter, described by Liebig, as being so difficult of treatment and slow of change, is rendered soluble by the process I have described; not only so, but the remaining organic matters are in a condition to undergo rapid change. We have in this powder from 50 to 60 per cent. of organic matter combined with salts of soda, and nitrogenous compounds soluble in water, this, surely, cannot fail to become a most important addition to our list of artificial manures. Sea-weed treated in the same manner yields still more remarkable results.

Trusting to be excused for this digression, I will return to the subject of charcoal. Some of the sawdust charcoal, of which a sample is on the table, has been manufactured into gunpowder of a very fine quality, but strange to say, there is little probability of its being generally used by powder manufacturers. With one honourable exception, all those whose attention I have called to this article, have declined to use it, or to adopt sawdust as a material for the manufacture of charcoal. One firm informed me that they never introduce any novelty until it has been fully approved by the Government; another used only elder; others restrict themselves to oak, willow, or dog wood, for the manufacture of charcoal, each firm enjoying the opinion that no other wood is fit for making powder of superior quality but the special kind they individually use; and then, why should they make any alteration for their fathers and grandfathers did the same before them. This will serve to show the difficulty that sometimes exists in introducing novelties, and getting them adopted by established manufacturers.

In conclusion, I trust I have furnished you with some points for discussion, which I consider the principal object of this paper.

Should it be my lot, in the ordering of an All-wise Providence, to be made the humble instrument of developing the resources of our bogs, and other unapplied and unappreciated products, to assist in raising the people of Ireland to a just appreciation of the vast mines of wealth that abound in their favoured land, it will be a source of satisfaction to me to the latest period of my life, independent of any pecuniary advantage I may derive.

* *Vide* "Journal of the Society of Arts," Vol. ii. p. 245.

CANADIAN INSTITUTE—SESSION 1854-55.

Eleventh Ordinary Meeting—March 3rd, 1855.

The name of the following candidate for membership was read:—

J. W. Dunbar Moodie .... County of Hastings.

The following gentlemen were elected members:—

D. L. Macpherson .... Toronto.
Patrick Macgregor .... "
Alexander Grant .... "
Alexander Logie .... Hamilton.
James Dunbar Pringle .... "
Thos. S. Hunt .... Montreal.

The following donations were announced from the Hon. J. M. Brodhead, Washington:—

1. Foster and Whitney's Report on the Geology of the Lake Superior Land District. Part II. The Iron District, with Maps.

2. Constitution of the United States of America, with other Political Documents and Statistical Information, completed by W. Hickey.

3. Patent Office Report for the year 1852. Part II. Agriculture.

4. Patent Office Report for the year 1853. Part II. Agriculture.
5. Patent Office Report for the year 1849-50. Agriculture.
6. Patent Office Report for the year 1849-50. Mechanical.

The thanks of the Institute were ordered to be conveyed to Mr. Brodhead.

A Paper was read by the Rev. Professor Hincks "On the Classification of Birds."

Twelfth Ordinary Meeting--March 10th, 1855.

The names of the following candidates for membership were read :—

Augustus Nanton .... Toronto.
William Couper.................................... "

The following gentleman was elected member :—

J. W. Dunbar Moodie............................ County of Hastings.

The following donation was announced :

"The Origin and Progress of the Mechanical Inventions of James Watt," by James P. Muirhead, M.A., 3 vols. Presented by George Wilson, jun., New York.

A communication on the subject of "Spurious Mexican Coins," was made by Professor Croft.

A paper "On the Indian Tribes of Canada," by the Rev. W. Bleasdell, M.A., was read.

A communication from Major Lachlan, Montreal, "On the Union of Lakes Erie and St. Clair," was read by the Secretary.

Thirteenth Ordinary Meeting--March 17th, 1855.

The following gentlemen were elected members :—

Augustus Nanton.................................. Toronto.
William Couper.................................... "

A Paper "On Railway Truss Bridges," by T. C. Clarke, C.E., was read by Sandford Fleming, C.E.

Professor Croft made some observations on a specimen of Bitumen from the Western District.

Professor Chapman described a convenient method of tabulating the organic remains found in different strata.

Fourteenth Ordinary Meeting--March 24th, 1855.

The names of the following candidates for membership were read :—

John Macpherson Hamilton...................... Toronto.
William Dixon .... "
Theodore Bown .... Hamilton.
R. James Johnston.................................. Thorold.
William H. Lambe.................................. Montreal.
Frederick W. Torrance .... "
Hon. John Young .... "

The Vice-President announced the receipt of several numbers of the "Boston Journal of Natural History," laid on the table by Mr. Ure.

It was resolved 'that the Canadian Institute, in returning their thanks to the Natural History Society of Boston, for their kindness in forwarding three parts of the sixth volume of their Journal, and several sheets of their Transactions, desire at the same time to express their readiness to transmit the "Canadian Journal" in exchange.'

A Paper "On the Origin of the Basins of the Great American Lakes," was read by Professor Hind.

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY OR STATED MEETING.

WEDNESDAY, 7TH FEBRUARY, 1855.

The following donations were announced, viz. :—

"Kugler's Handbook of Painting," edited by Sir E. W. Head, presented by the Governor General.

"Abstract of Meteorological Observations made at the Magnetic Observatory at Toronto, from January, 1840, to June, 1853."

"Geological Map of Canada," and a "Table giving the five-day Means of the Temperature of Toronto, from twelve years' observation," presented by E. A. Meredith, Esq., LL.B.

"Statement of Vessels arrived at the Port of Quebec in each year, from 1764 to 1854 inclusive, with their Tonnage and Number of Men," presented by the Hon. Henry Black, Q.C.

"Proceedings of the Royal Society, Vol. 7, No. 3," presented by Lieutenant Noble, R.A., F.R.A.S.

The thanks of the Society were ordered to be given to His Excellency and the other gentlemen above-named, for their respective donations.

The Hon. John A. Macdonald, Attorney General for Upper Canada, and F. T. Roche, Esq., were proposed as Associate Members.

Lieut. Noble, R.A., F.R.A.S., communicated to the Society, at the request of Lieut. Rankin, R.E., a Formula for ascertaining the height of mountains, which that gentleman states has been recently submitted to the scientific world in Edinburgh :—

$$h = 517\,t + t^2,$$

where h is the height of mountain in feet, t the difference between temperature at which water boils at summit and base of mountain.

The thanks of the Society were ordered to be given to Lieut Rankin, R.E. for his interesting communication.

A Paper was read by Lieut. H. G. Savage, R.E., on the "History of British Poetry."

The thanks of the Society were ordered to be given to Lieut. H. G. Savage, R.E., for his Paper, which was referred to the Class of Literature.

MONTHLY GENERAL MEETING.

WEDNESDAY, 14TH FEBRUARY, 1855.

A donation was announced of "A Copy of Meteorological Observations, made at the Magnetic Observatory at Madras, in the years 1846 and 1850," from the Court of Directors of the Hon. East India Company.

The thanks of the Society were ordered to be given to the Court of Directors for their donation.

The 21st of February being Ash-Wednesday, no stated meeting of the Society was held.

HENRY E. STEELE,
Recording Secretary.

Brief History of the Catawba Grape.

The Catawba grape, according to the *Home Journal*, was first discovered near Asheville, in Buncombe county, North Carolina, in the southwest corner of the State, near the head waters of the Catawba River. It was found by a Mr. Murray, about the year 1801; the grapes were growing wild in the woods in the greatest profusion. General Davy, a Senator in Congress, living at Rocky Mount, on the Catawba River, transplanted some of these grapes to his residence, and from thence took a few plants with him to Washington during the period of his senatorship—some time prior to 1816. From or through him the distinguished Major Adlum obtained some of the plants, and was the first person who made wine from them—about 1822. In 1823 he sent some of the plants, with specimens of the wine, to Mr. Longworth, of Cincinnati, to whom we are thus indebted for its first introduction in the West.

There are several other varieties of native grapes from which small quanities of wine are made, but they are generally inferior in many respects to the Catawba ; from the wine of this grape, which has undergone simple fermentation, is made the celebrated "sparkling wine," first introduced to the world at Cincinnati, in whose vicinity there is at the present time near fifteen hundred acres in cultivation, producing an average yield of three hundred gallons to the acre ; dur-

ing the past season some have realized as high as five hundred, seven hundred, eight hundred, and eight hundred and fifty gallons to the acre.

The success in producing wine from this grape is in some measure to be attributed to the greater length of the seasons and the character of the soil in this vicinity. It being absolutely necessary to make wine from this or any other grape, that it should reach the degree of ripeness or maturity which will furnish the requisite amount of sugar or saccharine matter to preserve the wine by its conversion into alcohol in the process of fermentation. Grapes may be considered ripe enough for eating, which would not do for wine making.

Substitutes for Citric and Tartaric Acids, and their Salts.

Gatty and Kopp employ lactic acid and the lactates. This acid, when used as a resist, is thickened with starch, and then printed by block or roller upon cloth, which is afterwards printed or padded with mordants. One gallon lactic acid at 40° Twaddle is used, instead of one gallon lemon-juice at 50° Twaddle. In cases where the lemon-juice is previously saturated with an alkali, the lactic acid is treated in the same manner.

When lactic acid is used as a discharge, it is thickened as in the above case, and printed upon cloth saturated with mordants, which it discharges by forming soluble salts with the oxides constituting the mordants. In using lactic acid to precipitate carthamine from the alkaline solution of safflower, 4 lbs. acid at about 40° Twaddle are used in place of 3 lbs. tartaric acid. In dyeing Prusian blue, scarlet, crimson, &c., on silk or wool, tartaric acid or cream of tartar is generally used. In such cases, lactic acid or bilactate of soda is applied, and the manipulations are the same as when tartaric acid is used, $1\frac{1}{4}$ lbs. bilactate of soda at 66° Twaddle serving for 1 lb. cream of tartar. When lactic acid is employed for steam colours, it is substituted for tartaric acid in the proportions already stated, the preparations of the colours being the same as when tartaric acid is used. Lactic acid may be applied in preparing white and coloured discharges upon Turkey red and other colours; the operation is managed just as if tartaric acid were used—only, after printing, the cloth should not be exposed to a long-continued heat, which, owing to a slight volatilization of the lactic acid, would reduce its discharging properties.

Belford's process depends upon the formation of an artificial tartaric acid by mixing oxalic acid with sugar, a substance containing the exact proportion of hydrogen in which oxalic acid is deficient. A quantity of sugar or treacle is drenched with nitric acid, and with some mother-water in which oxalic acid has been crystallised. As soon as nitrous vapours cease ascending, more nitric acid is added, and the solution is then concentrated until a crystalline mass is obtained on cooling. This mass consists of slender crystalline needles, and is next washed for obtaining the acid. After washing the crystals, add sugar which has been dissolved in some of the washing liquor, the quantity of sugar required being proportional to the degree of acidity which it is desired to attain. The syrupy fluid is then concentrated at a gentle heat, and left to crystallise at a moderate temperature. Or, take one part of sugar or treacle, and add one-third acetic acid, and three parts nitric acid at 36° Twaddle. This yields an oxalic acid containing more hydrogen than the common oxalic acid (? !). The crystals obtained from this solution are purified by washing and re-crystallisation. The oxalic acid thus obtained may be converted into tartaric acid by deoxidisation. This is effected by dissolving sugar in the washing liquor and mixing with the acid. The solutions, when concentrated at a low temperature and crystallised, yield so-called "tartaric" acid. The wash liquors when concentrated may be used as mordants.

Murdock substitutes for cream of tartar, and for the mixture of cream of tartar with alum, common salt with nitric acid, and sulphate of alumina. 100 lbs. salt are mixed with 300 lbs. of water, and when dissolved, 20 lbs. nitric acid are introduced. When alum is required, 100 lbs. sulphate of alumina are gradually added. The water should be cold, and the mixture but slightly stirred.

Canadian Marble.

We have been favoured with some hand specimens of different varieties of marble from the quarries of Messrs. Nicholls & Co., in the township of Marmora. The marble is within two feet of the surface of the ground. The river Moira runs across the corner of the lot on which the quarry is situated, and offers available power for the requisite machinery in a marble manufactory. The distance of these quarries from Cobourg is about 50 miles, and from Belleville nearly 30 miles. From the circumstance of their proximity to the Marmora iron works, it is probable that the distance from a port will not long continue to be a serious obstacle against the general adoption of Canadian marble for ornamental and useful purposes. It is not generally known that a large supply of very good marble can be obtained from many parts of Canada. Notices of localities where marble may be procured are interspersed throughout the Reports of the Geological Commission:—Mr. Logan says that, some beds of the Chazy limestone in the neighbourhood of Montreal are known to take a moderately good polish, and they are cut into slabs for the purpose of chimney-pieces, and occasionally for tables, one of which, manufactured by Mr. Hammond of Montreal, and sent to the London Industrial Exhibition of 1851, attracted attention, and was readily sold. The colour of these slabs is a dark grey; in some parts of the district the grey shews occasional spots of red, as on Madame Nolan's farm at Ste.-Catharine, and on Isle-Bizard; but in seigniory of La-Chenaye, on the Little River, about a mile from St.-Lin, massive beds of the formation become almost wholly red, and give large slabs of a very handsome aspect. The beds are composed of a mass of comminuted organic remains, consisting of shells and corals, the latter predominating, and the prevailing species being *Chœtites lycoperdon*. The corals are coloured ochre-red, while some of the shells approach rather a rose-red, and parts of the stone are mottled with a greyish-red running irregularly over the surface. A large supply of this marble might easily be procured.

On the Separation of Silver from Lead.—At a meeting of the Royal Cornwall Polytechnic Institute, Mr. J. A. Phillips, of London (formerly of the Museum of Economic Geology), said that one of the most important improvements which had recently been made in the metallurgical art came into operation last year, and is the separation of silver from lead by means of zinc. After describing the old process of separation, and the subsequent process discovered by Mr. Pattinson, of Newcastle-on-Tyne, involving several crystallisations and a final cupilation, he stated that still more recently a patent had been taken out by Mr. Parkes for a process by which he separates the silver entirely by one operation. To do this, the alloy of silver and lead is melted in the usual way in a large iron pot; to this a small quantity, a few pounds of zinc per ton, is added, the whole mixed up and allowed to remain a short time. By this means the silver is brought to the surface in the form of alloy with the zinc, and this mixture is subsequently skimmed off and treated for the silver it contains. In order to do this, the zinc is first partially separated by oxidation, and the residual alloys afterwards treated in the cupel. In connexion with the purification of metals, he might mention some of his own experiments in regard to tin. The tin from Peru and some other countries contains a large amount of tungstan, or wolfram, which very much depreciates its value. Till recently this tin could only be employed for very common purposes, such as making tin pipes and other things which did not require tin of good quality. But in analysing some of this tin he happened to discover a process by which the separation was very easily effected, and this process had been recently patented. It consists in taking impure tin, containing from 5 to 10 per cent. of tungstan (worth £25 per ton less than tin of ordinary purity), granulating it by melting it in a reverberatory furnace, and allowing it to flow into a vessel containing water. This granulated tin is then placed in a pan with common hydrochloric acid, which may be obtained from the soda manufacturers at almost a nominal price. This being heated, hydrogen gas is evolved, and a solution of chloride of tin is obtained. In this operation it is necessary that the tin should be present in excess; unless it be so, a certain portion of tungstan be dissolved. Should, however, the operation be carried on too far, and a portion of tungstan will be dissolved, the addition of a small quantity of impure tin precipitates the tungstan, and chloride of tin, free from tungstan, is obtained. This is turned off into a vat, in which more granulated impure tin is placed, and any arsenic or antimony remaining is there deposited, and a pure solution of chloride of tin obtained. From this we have to get the chemically pure tin we require, and which is quite as good as the stream tin of Cornwall. Into this bath we put bars of metallic zinc, which precipitates the tin in a spongy mass, when instead of chloride of tin we get chloride of zinc. The tin thus produced may be fused into bars, or sold as the best tin. The chloride of zinc must be so used as to lower the expense of the whole process. To do this, it is precipitated by milk of lime, or common chalk; we then get oxide of zinc, which is largely used as a pigment; and to give it sufficient opaqueness for that purpose, the washed oxide of zinc is heated to redness, when it is found to be equal to the ordinary oxide of zinc obtained by sublimation.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—February, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude*, 79 *deg.* 21. *min. West. Elevation above Lake Ontario*, 108 *feet.*

Day.	Barom. at temp. of 32 deg.				Temp. of the Air.				Mean Temp.	Tension of Vapour.				Humid'y of Air.				Wind.				Rain	Snow
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.	+ or — of the Average	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	in Inch	in Inch.
1	29·596	29·458	29·510	29·524	15°·4	25°·4	—1°·4	12°·3	—11°·6	0·080	0·108	0.034	0·070	·87	·78	·74	·78	Calm	W	Calm	7·47	...	0·5
2	·335	·263	·195	·260	8·6	21·7	20·5	17·1	— 6·8	·058	·088	·098	·080	83	74	86	80	W S W	W S W	W	11·40	...	0·4
3	·264	·344	·391	·350	4·8	14·8	7·5	8·1	—15·6	·050	·066	·044	·052	85	73	66	75	W	W	W S W	13·97	...	0·5
4	·513	·425	—	—	-11·0	1·7	—	—	—	·021	·038	—	—	75	75	—	—	N b E	Calm	Calm	4·13	...	0·3
5	·356	·316	·686	·457	—9·0	6·6	-15·1	-7·6	—31·2	·019	·048	·010	·025	61	75	44	66	N N W	W N W	N	8·27	...	0·1
6	·763	·746	·763	·753	-24·2	-10·4	-10·6	-14·4	—37·9	·007	·020	·027	·023	45	65	90	68	N N E	NE b N	NE b N	9·19	...	2·5
7	·686	·527	·446	·546	—9·8	2·5	6·1	-0·3	—23·7	·023	·042	·058	·043	77	80	92	85	NE b N	N E	N E	13.21	...	2·5
8	·481	·455	·496	·484	5·0	15·6	13·8	11·1	—12·3	·054	·066	·081	·063	90	71	93	80	N b E	N b E	N b W	6·92	...	0·1
9	·496	·560	·692	·591	11·5	18·0	—2·5	9·3	—14·0	·069	·088	·034	·064	89	85	84	84	N b W	W N W	N N W	3·52	...	Inap.
10	·730	·716	·634	·691	10·7	23·3	19·0	17·7	— 5·6	·064	·088	·092	·082	83	69	85	80	Calm	S W b W	S W b S	6·06	...	4·0
11	·467	·554	—	—	19·4	28·7	—	—	—	·075	·099	—	—	68	62	—	—	S	Calm	Calm	2·07	...	...
12	·819	·764	·696	·759	14·4	28·7	28·7	14·2	+ 0·9	·076	·146	·145	·118	86	92	92	87	N b E	E S E	E b S	11·14	...	5·0
13	·624	·592	·505	·571	31·2	35·0	34·1	33·5	+10·3	·160	·168	·195	·175	92	83	99	92	E S E	E b N	E b N	12·36	1·705	...
14	·433	·451	·545	·480	34·8	36·2	33·9	34·8	+11·6	·199	·207	·179	·193	99	98	93	96	E N E	N N E	Calm	2·44	0·065	...
15	·526	·469	·441	·473	31·2	37·3	31·6	33·1	+ 9·8	·164	·193	·162	·171	94	87	92	91	S W b S	N W	N W	6·65	...	4·0
16	·359	·402	·488	·423	28·4	32·7	29·1	28·6	+ 5·2	·142	·164	·149	·143	90	89	94	90	N W b W	W S W	W	4·86	...	1·5
17	·526	·553	·611	·567	23·7	32·1	26·6	26·8	+ 3·5	·113	·157	·130	·130	86	87	89	87	W S W	W	W N W	5·51	...	0·2
18	·622	·612	—	—	25·2	34 1	—	—	—	·123	·162	—	—	89	82	—	—	W	N W	N W b N	11·50	...	Inap.
19	·694	·685	·754	·717	22·6	28·4	24·1	23·9	+ 0·4	·107	·139	·115	·114	85	89	86	86	N W b N	N N W	N N W	13·95	...	0·2
20	·830	·870	·965	·910	19·7	31·2	19·9	23·1	— 0·5	·094	·129	·081	·100	85	75	73	78	N N W	N W b N	N W	8·83	...	...
21	·991	·962	·859	·936	14·8	33·5	15·4	20·8	— 3·0	·078	·130	·064	·090	86	69	68	75	W N W	S W b S	S W b S	1·95	...	...
22	·696	·650	·776	·712	26·2	33·3	24·4	26·5	+ 2·6	·132	·144	·120	·126	91	75	89	86	S W	N W b W	N b W	11·76	...	...
23	·834	·831	·858	·843	5·0	11·6	0·7	4·6	—19·3	·043	·053	·032	·041	73	67	65	69	N	N N W	N N W	7·77	...	...
24	·858	·774	·776	·797	—6·4	13·6	—1·4	2·3	—21·9	·027	·067	·037	·042	76	77	84	75	W N W	W b N	W b N	6·90	...	...
25	·676	·522	—	—	—8·2	13·1	—	—	—	·024	·045	—	—	71	53	—	—	W b S	W	W	12·66	...	...
26	·443	·382	·463	·435	6·1	16·3	13·3	11·7	—12·8	·043	·060	·069	·058	70	63	81	73	W b N	W b N	W	12·75	...	Inap.
27	·536	·679	·829	·705	11·5	17·2	6·1	11·3	—13·4	·068	·069	·047	·059	86	69	76	75	N N W	N W b W	N N W	8·87	...	...
28	·928	30·002	30·076	30·011	1·5	20·8	10·1	11·4	—13·5	·040	·050	·059	·051	80	44	80	67	W b N	N N E	W N W	2·65	...	...
																		Miles.	Miles.	Miles.	Miles		
M	29·617	29·602	29·644	29·625	11·6	21·9	13·9	15·4	— 8·3	0·080	0·104	0·086	0·088	·83	·76	·82	·80	6·49	10·14	8·56	8·17	1·770	21·8

Highest Barometer...... 30·088, at 12 p.m. on 28th } Monthly range:
Lowest Barometer....... 29·172, at 12 p.m. on 2nd } 0·916 inches.
Highest registered temperature +39°·0, at p.m., 15th } Monthly range:
Lowest registered temperature —25°·4, at a.m. on 6th } 64°·4.
Mean Maximum Thermometer.............. 23°·19 } Mean daily range:
Mean Minimum Thermometer............ 4°·81 } 18°·38.
Greatest daily range.........34°·2, from p.m. of 5th to a.m. of 6th.
Least daily range .... 5°·9, from p.m. of 13th, to a.m. of 14th.
Warmest day....... 14th. Mean temperature......+34°·83 } Difference,
Coldest day......... 6th. Mean temperature......—14°·38 } 49°·21.
Greatest intensity of Solar Radiation, +60°·5 on p.m. of 15th } Range,
Lowest point of Terrestrial Radiation, —31°·0 on a. m. of 6th } 91°·5.
Aurora observed on 4 night: viz. 9th, 11th, 20th, and 21st.
Possible to see Aurora on 12 nights. Impossible on 16 nights.
Raining on 2 days. Raining 20·5 hours; depth, 1·770 inches.
Snowing on 14 days. Snowing 98·0 hours; depth 21·8 inches.
Mean of Cloudiness, 0·71.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North—2713·64 West—2786·04 South.—463·75 East—937·49.
Mean direction of the Wind, N 37° W.
Mean velocity of the Wind, 8·17 miles per hour.
Maximum velocity, 25·0 miles per hour, from 3.30 to 4.30 p.m. on 1st.
Most windy day, the 3d; mean velocity, 13·97 miles per hour.
Least windy day, the 21st; mean velocity, 1·95 " "
Most windy hour, 9 p.m. Mean velocity, 10·45 miles per hour.
Least windy hour, 4 a.m. Mean velocity, 5·92 miles per hour.
Mean diurnal variation, 4·53 miles.

The mean temperature of this month has been 7°·7 below the average, being the coldest month during the 16 years, with the single exception of February, 1843. The minimum temperature, —25°·4, is the lowest on record; the nearest approach to it being —18°·4, which occurred on January 16th, 1840.

The first ten days of the month were remarkable for a continuance of extreme cold, the fifth and sixth days (—7°·6 and —14°4) being the coldest yet recorded, the next coldest day of the whole series being Jan 10th, 1848, the mean temperature of which was —5°·3. The range of temperature on the whole month has been very great (64°·4), and has only once been surpassed, namely, in April, 1842, in which month the extreme range (69°7) was caused by an unusually high temperature for the season (89°·8), supposed to be occasioned by a fire in the western woods. The barometer has been remarkably steady during the month, and high winds have been prevalent, though without attaining extreme violence. The velocity of the wind for the whole month is not only the greatest for any February yet recorded, but absolutely the highest for the eight years, with the single exception of December, 1854.

23d, at 7 a.m.—Segment of halo round the sun, and very bright Parhelion on the south side of the halo.

Comparative Table for February.

Year.	Temperature.					Rain.		Snow.		Mean Velocity.	
	Mean.	Dif. from Av'ge	Min. obs'vd	Max. obs'vd	Range	D's.	Inch.	D's.	Inch.		
1840	28·0	+4·9	— 8·3	49·1	57·4	8	1·475	6	...	...	
1841	22·4	—0·7	— 0·3	43·4	43·7	1	0·000	9	...	0·61	℔.
1842	26·9	+3·8	+ 2·5	48·7	46·2	8	3·625	9	...	1·03	℔.
1843	14·5	—8·6	—10·2	37.5	47·7	1	0·475	21	14·4	1·05	℔.
1844	26·0	+2·9	— 0·4	47·1	47·5	4	0·430	7	10·0	0·43	℔.
1845	26·0	+2·9	— 3·9	46·6	50·5	5	Impf.	9	19·0	0·99	℔.
1846	20·4	—2·7	—16·2	41·4	57·6	0	0·000	13	46·1	0·65	℔.
1847	21·5	—1·6	— 1·0	42·2	43·2	2	0·550	13	27·3	0·69	℔.
1848	26·6	+3·5	— 0·6	46·9	47·5	4	0·775	8	10·8	5·69	Miles.
1849	19·5	—3·6	— 9·2	41·1	50·3	2	0.240	13	19·2	6·58	Miles.
1850	26·0	+2·9	+ 1·3	49·2	47·9	7	1·235	9	23·1	7·61	Miles.
1851	27·6	+4·5	+ 1·3	50·2	48·9	7	2·600	4	2·4	6·94	Miles.
1852	23·4	+0·3	— 3·2	41·2	44·4	3	0·650	11	13·0	6·42	Miles.
1853	24·1	+1·0	— 0·6	43·4	44·0	4	1·030	15	12·6	7·29	Miles.
1854	21·1	—2·0	— 5·7	42·7	48·4	5	1·460	15	18·0	6·91	Miles.
1855	15·4	—7·7	—25·0	37·3	62·3	2	1·770	14	21·8	8·17	Miles.
										0·78	℔s.
M'n.	23.09		—4·97	44·25	49·22	3·9	1·088	11.0	18·3	6·95	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—February, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	29·840	29·750	29·598	– 7·9	17·0	9·0	·028	·095	·067	·80	·93	·90	S W b W	S b W	S b W	2·02	0·78	0·57	...	...	Clear.	Cir. Cum. 4.	Cir. Cum. 4.
2	·595	·500	·510	– 7·0	21·0	16·1	029	112	091	83	95	94	S S W	S W b W	S W	5·25	9·00	6·42	...	Inap.	Do.	Snow.	Cum. 4.
3	·400	·487	·544	– 4·0	15·6	9·0	036	088	067	86	93	94	W N W	W	W b N	0·22	5·52	6·32	...	...	Hoar Frost.	Cir.Cum.Str.4	Cir. Str. 4.
4	·654	·698	·700	–14·8	–10·3	–22·3	021	028	015	83	90	88	W b N	W	N W	13·37	9·30	3·86	...	...	Clear.	Clear.	Clear.
5	·516	·590	·710	–26·1	– 5·5	–20·0	008	034	015	49	84	79	N E b N	N E b N	N W b W	6·52	2·86	1·65	...	...	Do.	Do.	Do.
6	·881	·991	30·046	–32·6	–18·6	–24·5	007	014	014	68	66	87	N W	S W	S W	5·65	Calm	0·25	...	...	Do.	Do.	Do.
7	30·069	30·061	29·936	–33·9	– 6·2	–11·0	003	029	026	29	80	92	E b N	N E b E	N E b E	2·57	0·40	4·47	...	...	Do.	Do.	Do.
8	29·806	29·790	·860	– 5·1	5·5	8·3	031	058	065	80	90	92	N E b E	N E b E	N E b E	1·12	1.21	18·77	...	Inap.	Str. 10.	Slight snow.	Str. 10.
9	29·724	·740	·780	8·2	16·3	12·1	058	077	076	82	73	90	N E b N	N E	N E b N	16·25	7·50	3·22	...	...	Do. 10.	Str. 10.	Do. 10.
10	·900	·987	·940	10·1	22·4	14·0	069	113	083	93	87	90	W b N	S W b W	S W b S	Inap.	1·30	0·90	...	...	Cir. Str. 4.	Cum. Str. 10.	Do. 10.
11	·850	·848	·941	12·4	29·2	7·5	080	161	062	83	89	93	S E	S E b E	W N W	0·40	0·52	Calm	...	...	Str. 2.	Do. 4.	Cl'r Auro.Bor.
12	30·025	30·242	30·244	– 3·0	24·5	4·7	041	127	056	95	85	95	W N W	S W b S	E N E	Inap.	Calm	Calm	...	...	Cir. Str. 10.	Cum. 4.	Do. do.
13	30·200	30·161	30·156	13·0	20·4	16·3	090	101	087	88	77	78	N E b E	N E b E	N E b E	1·58	4·32	5·00	...	...	Str. 10.	Str. 10.	Do. do.
14	30·120	30·051	30·041	16·0	30·9	30·6	098	171	178	88	89	92	N E b E	N E b E	E N E	8·76	0·87	9·44	...	6·70	Sleet.	Snow.	Snow.
15	29·912	29·810	29·795	30·4	32·2	32·0	176	191	199	91	95	1·00	N E b E	N E b E	N E b E	11·63	7·50	2·50	...	2·80	Str. 10.	Str. 10.	Snow.
16	·730	·700	·730	31·8	38·7	33·1	192	196	197	99	77	94	N E b E	N E b E	N E b E	33·00	8·75	8·96	...	4·20	Snow.	Do. 4.	Str. 10.
17	·740	·711	·720	29·9	33·1	30·1	171	197	171	92	94	95	N E b E	N E b E	W b S	1·05	1·76	13·75	...	0·50	Str. 10.	Snow.	Cir. Str. 10.
18	·680	·660	·670	28·8	38·1	32·5	170	226	196	94	91	92	W b S	N W bW	N W	5·44	4·62	7·40	...	...	Clear.	Cir. Str. 4.	Sl't snow.
19	·700	·735	·810	20·8	27·5	24·0	118	153	130	88	88	86	W	W	W	7·50	8·75	4·96	...	Inap	Str. 10.	Str. 10.	Str. 10.
20	·873	·890	·990	21·0	28·6	26·2	116	144	154	86	83	95	W	W	W N W	1·90	4·28	3·52	...	...	Cum. Str. 10.	Cir.Cum.Str.4	Cum. Str. 4.
21	30·120	30·150	30·090	22·1	34·4	21·0	115	195	111	83	90	84	W	W S W	S W b W	4·10	1·00	1·06	...	...	Str. 10.	Clear.	Do. 4.*
22	29 941	29.820	29·800	19·0	37·0	23·0	110	167	125	88	70	84	W	S b W	N W b W	2·12	0·11	2·00	...	...	Do. 10.	Cum. Str. 8.	Str. 4.
23	·900	·941	·943	– 7·0	5·8	– 2·0	030	051	041	86	79	90	W b N	W	N W b W	14·48	5·22	4·12	...	...	Clear.	Clear.	Clear.
24	·910	·800	·792	–15·2	– 1·0	– 7·5	018	038	028	69	83	81	N W b W	W b S	W b S	3·75	21·36	3·70	...	...	Do.	Do.	Do.
25	·600	·451	·438	– 8·5	5·4	0·2	031	051	042	90	79	85	W b S	W b S	W b N	12·89	3·75	16·82	...	...	Str. 4.	Str. 8.	Slihgt Snow.
26	·400	·439	·486	0·3	15·8	10·4	047	098	077	90	88	83	W b N	W b N	W b N	17·20	11·25	10·00	...	0·80	Do. 10.	Cum. Str. 8.	Str. 9.
27	·590	·671	·840	4·5	18·4	14·7	047	099	089	80	82	83	W b N	W b N	N W b W	12·28	11·95	9.50	...	...	Do. 10.	Clear.	Do. 10.
28	30·030	30·110	30·199	0·0	14·7	9·0	044	089	067	80	82	90	N	N b W	W b S	0·96	0·62	1·70	...	...	Clear.	Do.	Clear.

Barometer ....
- Highest, the 12th day .... 30·244
- Lowest, the 26th day .... 29·400
- Monthly Mean .... 29·819
- " Range .... 0·844

Thermometer.
- Highest, the 16th day .... 40°·6
- Lowest, the 7th day. ....—33°·9
- Monthly Mean .... 11°·23
- " Range .... 74°·5
- Mean Humidity .... ·857

Greatest Intensity of the Sun's Rays .... 98°·4

No Rain fell during the month.

Snow fell on 8 days, amounting to 15 inches. Snowing 21 hours 50 minutes.
Most prevalent Wind, N.E. b E. Least prevalent Wind, N.
Most Windy Day, the 16th day; mean miles per hour, 15·87.
Least Windy Day, the 12th day; mean miles per hour, 0.00
Aurora Borealis visible on 2 nights. Might have been seen on 10 nights.
Lunar Halo visible on 1 night.
Mock Suns, (Parhelia) were seen on the morning of the 5th day.
The Electrical state of the atmosphere has been marked by moderate intensity, excepting the 14th and three following days, when it indicated a very high tension.
Ozone was often indicated, and in large quantities.
Mean of the month below that of last year 0°97.

* Lunar Halo, diameter 38°·0.

Monthly Meteorological Register, Quebec, Canada East, February, 1855.

BY LIEUT. A. NOBLE, R. A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	29·720	29·571	29·450	29·580	– 3·1	6·0	0·4	1·1	0·038	0·053	0·047	0·046	93	85	97	92	W N W	W	E S E	3·8	2·0	2·0	...	...	1st. Lunar Corona at 10 p.m.
2	·483	·350	·379	·404	– 2·0	8·8	14·8	7·2	·052	·056	·087	·065	100	80	97	92	S W	Calm.	Calm.	5·2	0·0	0·0	...	2·6	
3	·286	·205	·307	·266	12·8	18·0	6·8	12·5	·078	·091	·056	·075	93	90	87	90	Calm.	S S W	W S W	0·0	2·0	5·2	...	1·5	
4	·339	·471	·594	·468	– 3·7	–11·7	–20·1	–11·8	·038	·025	...	...	95	90	...	...	W	N W	W N W	6·2	5·2	2·0	...	...	3rd. Auroral arch 4° above the horizon, and occasionally a few streamers, observed this about 11 p.m.
5	·525	·439	·543	·502	–27·2	–10·2	–13·2	–16·9	...	·026	·025	...	...	87	93	...	N W	N E b E	N W	2·0	3·8	5·2	...	...	
6	·683	·807	·961	·817	–23·7	–16·3	–22·0	–20·7	...	·018	...	...	...	82	...	...	W	W	Calm.	5·2	6·2	0·0	...	...	
7	30·061	30·070	·953	30·028	–26·2	–12·7	– 9·1	–16·0	...	·020	·030	...	...	74	97	...	S W	N N W	E	3·8	3·8	2·0	...	...	
8	29·854	29·742	·681	29·759	– 6·0	8·3	9·4	3·9	·032	·053	·070	·052	89	77	98	88	N E	N E	N E	3·8	5·2	8·8	...	1·8	
9	·644	·619	·639	·634	10·2	12·6	11·5	11·4	·065	·064	·073	·067	88	79	94	87	E N E	E N E	E N E	11·3	10·9	7·2	...	0·5	
10	·724	·759	·795	·759	9·2	18·6	14·9	14·2	·067	·076	·070	·071	94	72	77	81	W	W	Calm.	2·0	2·0	0·0	...	...	4th. At 5 p.m., dry bulb —17°·7, wet bulb—14°·9, observed dew point —27°·0.
11	·806	·748	·805	·786	12·3	18·4	15·6	15·4	·069	·087	·088	·081	83	83	95	87	E	E	Calm.	3·8	3·8	0·0	...	0·3	
12	·947	30·023	30·116	30·029	6·5	21·7	13·3	13·8	·060	·104	·073	·079	94	87	85	89	S W	W	Calm.	2·0	2·0	0·0	...	...	
13	30·180	30·150	30·089	30·140	5·4	18·7	20·9	15·0	·057	·085	·111	·084	92	81	96	90	Calm.	E N E	E N E	0·0	11·5	18·3	...	...	
14	30·100	30·137	30·078	30·105	21·6	24·8	28·1	24·8	·108	·115	·138	·120	90	83	88	87	N N E	E N E	E N E	16·0	15·2	16·0	...	6·3	11th. At 10 p.m., snowed for two hours, although the sky was cloudless.
15	29·921	29·848	29·791	29·853	29·4	31·8	33·2	31·5	...	·167	·144	...	...	94	75	...	E N E	E N E	E N E	17·9	21·3	22·7	...	5·4	
16	·666	·692	·647	·668	33·5	34·1	30·6	32·7	·109	·156	·154	·140	84	78	89	84	E N E	E N E	E N E	32·2	11·5	21·3	0·05	0·5	
17	·601	·565	·513	·560	29·6	31·7	31·2	30·8	·153	·161	·168	·161	94	91	96	94	E N E	E N E	E N E	22·7	15·2	2·0	...	3·9	
18	·466	·435	·404	·435	30·9	29·4	28·7	29·7	·167	·154	·155	·159	96	94	98	96	N E	N E	Calm.	3·8	8·0	0·0	Inap.	5·4	12th. A good aurora observed.
19	·443	·523	·604	·523	27·9	29·8	28·3	28·7	·146	·156	·150	·151	96	95	96	96	N E	N E b E	Calm.	8·8	10·0	0·0	...	1·3	
20	·627	·674	·811	·704	28·6	34·4	30·2	30·9	·153	·171	·154	·159	99	86	91	92	W S W	Calm.	Calm.	5·2	0·0	0·0	...	0·1	
21	·929	·932	·897	·919	27·9	34·5	29·9	30·8	·140	·129	·144	·138	90	64	87	80	W	Calm.	Calm.	2·0	0·0	0·0	...	...	
22	·792	·621	·528	·647	25·2	27·1	25·9	26·1	·124	·115	·129	·133	89	97	89	92	N N W	N N W	W N W	10·0	8·0	9·3	Inap.	0·3	
23	·673	·716	·714	·701	– 1·8	3·7	– 2·5	– 0·2	·037	·040	·033	·037	87	71	79	79	W N W	W	W	11·3	9·3	10·9	...	...	27th. A good aurora observed.
24	·726	·653	·557	·645	–12·0	– 5·7	– 7·7	– 8·5	·023	·032	·030	·028	86	89	91	89	W	W N W	W N W	8·8	13·4	10·9	...	...	
25	·358	·225	·229	·271	– 8·5	– 1·6	– 1·6	– 3·9	·030	·040	·042	·038	91	91	95	92	W	W	W S W	8·8	8·0	5·2	...	0·2	
26	·223	·281	·364	·289	– 2·1	3·5	– 1·8	– 0·1	·050	·047	·041	·046	90	94	94	93	Calm.	N E	N E	0·0	5·2	5·2	...	...	
27	·330	·486	·678	·498	– 8·9	5·5	4·7	0·4	·031	·012	·013	·039	97	69	72	79	Calm.	E	W	0·0	5·2	5·2	...	...	
28	·827	898	·999	·906	3·7	18·1	16·0	12·6	·046	·076	·072	·065	82	73	76	77	W N W	W N W	W N W	7·2	11·5	6·2	...	...	
	29·6763	29·6657	29·6831	29·6749	6·75	13·62	11·30	10·55	0·080	0·093	0·092	0·088	91	83	90	88				7·28	7·15	6·02	·05	30·1	

Maximum Barometer, 6 a.m. on the 15th .... 30·180
Minimum Barometer, 2 p.m. on the 3rd., ... 29·205
Monthly Range .... ·975
Monthly Mean .... 29·6749
Maximum Thermometer on the 21st .... 36°·8
Minimum Thermometer on the 4th .... —29·5
Monthly Range .... 66·3
Mean Maximum Thermometer .... 15·65
Mean Minimum Thermometer .... 2·39
Mean Daily Range 13 26
Mean Monthly Temperature .... 10·55
Greatest Daily Range of Thermometer on 22nd .... 32°·2
Least Daily Range of Thermomter on 19th .... 3°·4
Warmest Day, 16th. Mean Temperature .... 32·7

Coldest Day, 6th. Mean Temperature .... —20·7
Climatic Difference .... 53·4
Possible to see Aurora on 11 Nights.
Aurora visible on 7 Nights.
Total quantity of Rain, ·05 inches.
Total quantity of Snow, 30·1 inches.
Rain fell on 3 days.
Snow fell on 14 days.

The observed Dew Point at 10 p.m. of 4th, —33°·5; at 6 a.m. of 5th, —34°·0; at 6 a.m. of 6th, —32°·5.

Note.—The 4th, 5th, 6th, 7th, and 15th days, are not included in forming the hourly and monthly means of Elasticity and Humidity.

The Canadian Journal.

TORONTO, MAY, 1855.

Some Notes of a Visit to the Works of the Grand Trunk Railway, west of Toronto, February, 1855.

By Fred. Cumberland, *Esq., Chief Engineer of the Ontario, Simcoe, and Huron Railway.*

(*Read before the Canadian Institute, March 31st.*)

Having been favoured some short time since with an invitation to join a party of gentlemen on a private inspection of the works in course of execution on the Grand Trunk Railway of Canada, west of Toronto, I availed myself of an opportunity I had long desired, and having seen much that interested, and I confess, surprised me, I thought some descriptive notes of the more interesting points upon the line might be acceptable to the Institute; and accordingly I propose (without entering upon any close or technical criticism), to offer to your notice this evening the memoranda I have preserved in connection with the principal objects which attracted my attention. Works of this nature seem amongst us to be objects of general interest only at the time of their initiation, or when, being completed, we discover that they are of some importance to us; or, if it be otherwise, the interest which they attract is too frequently founded on a restless spirit of suspicion—a wilful faculty too prevalent amongst some of us for adopting a system of depreciation, instead of (what my experience teaches me would be the wiser one), of encouragement and support.

When I started on my visit, therefore, I had not been prepared by rumour to find very much to gratify or surprise me, and as I think it part of the business of this Institute to trace out and follow, as far as the opportunities of its members will admit, the progress and the manner of the public works constructing about us, it may not be altogether unprofitable perhaps if I acquaint you with what is doing on this line.

Most of us are acquainted with the system of construction adopted by the Province as the standard of the Grand Trunk Railway—that it is one of more substantial character than had previously obtained either in the United States or Canada, founded indeed on the British system, so far qualified and lowered, however, as was necessary to economy, yet consistent with stability and permanence. The first illustration of this standard of any moment is to be found in the Humber Viaduct, 8½ miles from Toronto, over the river and valley of that name. At the point of crossing, this valley (extremely picturesque in character), is 1500 feet wide between bold and precipitous banks, giving an elevation of 68′0 to grade line above the stream. The viaduct consists of 8 piers and 2 abutments, giving nine spans of 60 feet each, and a total length of structure of 560 feet, the remainder of the crossing being effected by embankments containing some 80,000 yards of material. The piers are of white brick on stone foundations, and will be spanned by wrought iron girders, the weight of metal in which will be somewhere about 150 tons. The construction of these girders being identical throughout the line (except for larger spans than those now mentioned) it may be well here to explain briefly that the guage being 5′ 6″ the girders are placed 7′ 6″ from centre to centre, the top and bottom flanges being 2′0″ wide and the main web 4′2″ in height, so that the clear width between the girders is identical with the guage of the road. Across, projecting over, and attached to these are heavy timber beams—upon which are laid the track strings—the whole width of the floor being 16.0 feet, the track occupying the centre and having a pathway on each side of it protected by handrails. It would be difficult to imagine a more simple or satisfactory system of construction than this, and on contemplating it one cannot help reverting with some regret to those not very distant times, (only immediately previous indeed to Stephenson and Fairbairn's enquiries in relation to the Menai Bridge), when the crossing of such a valley as the Humber would have been effected by a structure involving much more intricacy of design, vastly more material, and far heavier expense. There is one consideration, however, which may qualify our lamentations on past labours lost, and it is this, that although economically these structures are far more satisfactory than those in which engineers but recently indulged, they are undoubtedly less pleasing to the eye and altogether injurious as in connection with the picturesque, for their outline consists of two-hard horizontal lines, without relief, break or beauty of any description, a form indeed which how grand soever the structures in themselves, will, I suspect, mar every landscape and parallyze the hand of the most soulless artist.

We next came to the Mimico Valley Viaduct, 12 miles from Toronto, consisting of one centre span of 60 and two side of 30 feet each, giving a full length of structure of 162 feet, 28 feet high above water line, and together, with an embankment of some 30,000 yards, constituting a crossing of 600 feet in length.

The next work of importance is that in the valley of the Etobicoke at Brampton, 20 miles from Toronto, which is 1500 feet wide, having two girder bridges of 60 feet span each.

At 27 miles from Toronto we come to the most important structure of the line, forming the crossing of the valley of the River Credit, 2000 feet in width between banks. It consists of 8 spans of 96 feet each, giving a full length of structure of 931 feet, the remainder of the crossing being by embankment containing about 150,000 yards of material, about half of which is from a cut on the west side in indurated clay similar to the specimen which I present.

The piers and abutments of this structure are constructed entirely of a very beautiful quality of sandstone of fine close and hard grit, and of a very agreeable warm colour. This stone is brought by tramroad from the Georgetown quarries, 4 miles distant, and as it has attracted much attention recently as a material available for Toronto works I have secured a specimen for your inspection. Of this the piers and abutments are constructed in courses rising from 2′6″ to 18″ in height, with self face, ¼″ beds and joints and bold 3″ drove arrises at the external angles, with two bold plinth courses and tooled capping for girders.

These masses of masonry, of a description unsurpassed by anything I had previously seen in Canada, rise to a height of 115 feet above the water line, and this in connection with the great length (nearly 1000 feet) results in an effect which is grand in the extreme, although of course the appearance is marred as yet by the incompleteness of the structure, the presence of temporary trustle work and the want of unity which the absence of the girders begets. On enquiry I find that the masonry, when complete, will consist of 13,000 cubic yards, and the weight of the wrought iron girders 405 tons Much as one is gratified on a first view of the Humber viaduct, on seeing that at the Credit one is tempted to regret the necessity existing there for the use of brick; for the Georgetown stone, built in the bold style adopted at the Credit, gives such complete assurance to the mind of permanent stability, and such satis-

faction to the eye by the play of colour on its face that it tends to dissatisfy one with a material in itself unimpeachable but relatively inferior. The girders to be used at the viaduct being of 96 feet span are of different construction to those we have already described. Instead of the two single web girders as at the Humber, here we have single tubular girders, 7′0″ high and 7′0″ wide, with the track on the top of it and projecting sidepaths as before, giving a full width of floor of 16′0″, each girder weighing somewhere about 50 tons.

In the same style of masonry and of material from the same quarries we came, at about a mile further westward, to a 25 foot arched culvert, with a vertical height of 6′0″ to springing, and containing, I was told, about 3,000 cubic yards, with an embankment over of about 194,000 yards, crossing a valley 1,500 feet wide. I observed here an excellent expedient for securing a double use to these culverts, for after allowing sufficient height for the passage of the stream, by making a set off on the face of each side wall a bearing is obtained, joisting laid and planked, and a roadway thus provided above the waterway. We subsequently visited a 15 foot arched culvert of similar character 1½ miles further westward, coming, at about 31 miles from Toronto, to what is called "the Lindsey cut," a work which has given much trouble in consequence of the character of the material—hard cemented gravel—through which it is made. Of this I have secured a specimen, and although probably most of us have encountered material somewhat approaching it in difficulty of working, few of us have been tried by a cut in it such as this, 50 feet in depth and containing 173,000 yards.

In succession to this cut and immediately beyond it we entered another 60 feet in depth, containing, we were told, about 25,000 yards, in limestone rock of excellent hydraulic quality, the cement from which, setting somewhat slowly but with great tenacity and hardness, has been generally used throughout the works.

Immediately beyond this again, after passing over the embankment filled from these cuts, we came to another (called Scots) which, containing upwards of 192,000 yards, it was a relief to find, of pure sand, although as it approached to quick, it seemed to give some indication of trouble

Passing a 15 foot arched culvert similar to those already described, at 36½ miles, we reached the summit between Toronto and Guelph, which is 991 feet above the level of Lake Ontario. Here is a cut in indurated gravel from which some 36,000 yards have been taken.

Three miles further westward is another 25 feet arched culvert, built in limestone of highly fossillated character. The style of this masonry was even heavier than that of those previously visited, but like those, it was finished with bold self-faces and drave arrises, the arch stones being, if I remember rightly, tooled. I name this because I think this style of masonry highly applicable to works of this nature, and far superior (by reason of the play about the face, relieved as it is by the wide arrises which define the strict outline of all angles) far superior to any higher finish or tooled faces which in my judgment impart tameness when adopted in massive structures.

At 40 miles from Toronto we come to the Eramosa Valley Viaduct over the river of that name and near the Village of Rockwood. The full width of this structure is 570 feet, comprising 8 spans of 60 feet each, the full width of valley being 1200 feet, crossed at an elevation of 45 feet above water line. The stone used in this structure is obtained in the immediate vicinity; the whole district around it, on the east side of the river, presenting a bare broken face of highly fossillated limestone rock, abounding, we were told, in caverns of large capacity and interesting character, well worthy of the visit, which want of time obliged us to decline. At Eramosa the style of masonry consists with that of the other structures, but the colour of the stone, which varies from grey to purple, and passes in parts into a lighter ochreous tint gives it a distinctive and peculiar aspect as compared with the other viaducts, and one which, although preferred by some of my companions, I did not admire so much as the warm and even face of the Georgetown material.

The quantity of stone laid in the Eramosa structure, (the masonry of which is fully completed), was 5000 yards, the embankment connected with it containing 80,000, and the weight of metal in the girders being about 125 tons.

Passing on to Guelph, (where the road seems to me to have been located somewhat strangely, although doubtless with good reason, right through the heart of the town), we find the most peculiar structure on the whole line, and one indeed for which few, if any, precedents can be found. This peculiarity is due to the crossing of the Speed River at right angles on and over the line of a street which is approached at each end and on each side of the river by other streets, also at right angles. In crossing the river therefore at this point it was necessary to preserve the common road on the same site as that to be occupied by the railway and to connect that roadway at each end with the streets abutting upon it. This has been affected by the viaduct in question, which is 580 feet in length, comprising six spans of 60 and one centre span over the river of 80 feet. But instead of solid piers of the usual width, there are two rows of piers, leaving a transverse opening of 20 feet wide between them, spanned by short transverse wrought iron beams to receive the longitudinal girders or tubes in the direction of the rail and roadway, so that throughout the length of some 600 feet the railway will be above the road for which a headway of about 20 feet will be left clear of the transverse beams before mentioned; in fact, except that this work is on *terra firma* it illustrates the same conditions of use as the new Suspension Bridge at Niagara, with the carriage way immediately beneath the railroad. That any local necessity exists for retaining the road in its old position or for forcing the location of the railway to its site is not very apparent, but Municipalities are not always as considerate as they should be, and seem sometimes disposed to test their strength by the pressure of some unreasonable prejudice.

At 53½ miles from Toronto, and 6 miles beyond Guelph, we visited what is called the "Jack hill cut," in indurated clay and hard pan, of a depth of 40 feet and contents of 161,000 yards. So close and compact is this material that the sides of the gully stand for the full 40 feet at a perfectly fair and vertical face; and I traced on part of it which had been excavated from nearly 2 years since, the marks of the pick as sharp and clean as though they had been recently made rather than stood exposure through two winters.

In connection with these deep cuts, I availed myself of the opportunity for noticing the effects of the then recent heavy fall of snow in relation to the probable obstruction of traffic. The general depth of snow over the surface of the country was from two to three feet, and it drifted very considerably in places, sufficient to illustrate fully the circumstances of our average winters. I found almost universally that cuts from 5 to 15 feet were comparatively choked by drift, and that as the depth above 20 or 25 feet increased, the deposit was diminished. In the cut at Jack's hill, 40 feet in depth, although the snow was two feet deep at the summit of the sides, there was cer-

tainly not more than from 2 to 4 inches in the bottom. This result has been attributed to active passage of the wind through the cut, although of course much must depend upon its direction as in relation to the bearing of the cut.

At 57½ miles from Toronto we came to the Grand River Viaduct, consisting of three land spans of 60 feet each, and two over the river of 96 feet each. The full width of the valley is 2500 feet, of which the structure occupies 440 feet, the remainder consisting of an embankment containing 130,000 cubic yards, the grade line being at an elevation of 47 feet above the water. The piers and abutments are constructed of a grey limestone (from quarries in the township of Puslinch, 12 miles south-eastward from the works), and built of the same class as I have before described, the quantity of stone laid being 4000 cubic yards, and the weight of metal in girders some 200 tons.

This was the last structure of importance which we visited. Passing through Petersburgh, however, we gained a point about 86 miles from Toronto, which is the summit of the whole road, and 1003 feet above the level of Lake Ontario and 664 feet above Lake Huron. These levels give a difference in altitude above the sea of 339 feet between Lakes Ontario and Huron, and this difference consists, within one foot, of that ascertained by the surveys of the Northern Railroad Company extended from Toronto to the Georgian Bay.

It does not, however, agree with Bayfield's observations as published in Scobie's maps,—where the difference is shewn to be 361 feet. The railway profiles, checked as they have been by each other, will probably be accepted as the more reliable, especially when we remember that Bayfield traced his levels through the St. Clair River, where we may conclude he made his error in exaggerating the fall.

Immediately to the southward of the summit, in the Township of Wilmot, and two miles west of Petersburgh, is a mound known as Earl's Hill, said to be the highest point in Western Canada, and ascertained by the engineer of the Guelph Railway to be 1186 feet above Lake Ontario. I have not had any opportunity since my visit to that point of ascertaining the height of the Blue Mountains of Collingwood, but I am strongly disposed to believe that their altitude is considerably in excess of that of Earl's Hill as reported.

Such is a brief sketch, descriptive of the principal structures and works of the Toronto and St. Mary's Railway. I have not attempted to do more than give an idea of their character, which is so simple as almost to make their description monotonous.

One system and principle of construction being adopted throughout, the only special exception being the Speed Viaduct at Guelph, little remained to be told, after one had been described, beyond the extent, capacity and materials of each. Together they form as perfect a group of railway structures as I ever desire to see, for whilst their simplicity satisfies the feeling of the most prudent economy, their materials are so exceptionable, the character of the workmanship so excellent, and the taste of their finish so fitting, that one is satisfied with them as works of the most substantial permanence. For my part, I confess to having been most agreeably surprised when I found works of such a class constructed in connection with a Canadian enterprise; and whilst the immediate object of this paper will have been served by directing the attention of the Institute to them, I shall be better pleased if it induces my engineering brethren to journey over the ground which I have travelled with so much satisfaction and not a little profit.

Additional Note on the Object of the Salt Condition of the Sea.

By Prof. Chapman, *University College, Toronto.*

(*Communicated to the Canadian Institute, April 14th,* 1855.)

Subsequent to the publication in the March number of our *Journal*, of a brief memoir on the object involved in the salt condition of the sea, my attention has been called by the Director of the Observatory at Washington—the well known Lieutenant Maury, of the United States Navy—to a very elaborate paper on the same subject, embodied in the explanatory portion of his admirable Wind and Current Charts.* On opening Lieutenant Maury's volume, my first impression was, that I had been anticipated in my views. This, however, is not the case, as will be seen by the subjoined letter, in which I have attempted a critical review of the entire question. According to Lieutenant Maury's theory, the sea is salt in order to *produce circulation*; according to mine, in order to *regulate evaporation*. The two, nevertheless, may not be irreconcilable. To a phenomenon, indeed, of so complicated a character, more than one object is undoubtedly attached.

TO LIEUT. MAURY, LL.D.

Superintendent of the National Observatory, Washington, &c.

Dear Sir,—I beg to return you my best thanks for your kind present of a copy of the sixth edition of the "Wind and Current Charts."

When I sent to the Canadian Institute my Note "On the Object of the Salt Condition of the Sea," believe me, I was altogether unaware of your previous publications on that subject. My paper was read and discussed some weeks before it appeared in the *Journal* of the Institute; but no notice of your highly important work was elicited from any of our members. As it is, I shall remedy the omission, so far as it lies in my power to do so, by calling attention to your views in an additional Note on the subject, to appear, if possible, in the May number of the *Journal.*

Will you allow me, however, with all due deference to one so deservedly distinguished in this branch of enquiry as yourself, to call in question the justness of some of your inferences?

If I understand the matter rightly, your hypothesis is to the following effect, namely, that the salt condition of the sea has for its object the production of a system of circulation; this circulation being effected, first, by the surface water becoming salter (and hence heavier) by evaporation, and so, sinking downwards, and giving place to the lighter water from below; and, secondly, by the labours of coral animals, and by vital agencies generally, in removing the lime and other salts.

To the correctness of the latter view, I most willingly concede; although I can scarcely look upon the cause in question as sufficiently intense to produce the phenomena of oceanic currents, according, if I mistake not, to your suggestion at page 188 of the above-mentioned work. This, however, in the present state of our knowledge, is a mere matter of opinion. The merit of the enunciation belongs entirely to you; for, although writer after writer has instanced the compensa-

* Explanatory and Sailing Directions to accompany the Wind and Current Charts." By M. F. Maury, LL.D., Lieut. U.S.N. 6th Ed., 1854. The study of this interesting volume cannot be too strongly recommended to all engaged in physico-geographical inquiries. At page 177 there is a distinct chapter on the "Saltness of the Sea."—E. C.

ting power of the marine Mollusks and Radiata,* in withdrawing from the sea the various salts brought into it by rivers, no one appears to have hinted, even, at the further effects due to this action.

But these organic agencies are mainly referrible to the abstraction of the lime salts from the sea water; the object of the chloride of sodium—the principal saline constituent of the pressure of the sea—being sought to be explained by the first hypothesis;† and it is here that I venture to differ from you, and to prefer my own explanation, as published in the March number of the *Canadian Journal.*

The surface water of the sea would necessarily be rendered salter, and consequently heavier, than the underlying strata, were no antagonistic influences at work; but I think we have sufficient experimental evidence to show that the effects of evaporation are counteracted by the constant additions of fresh water which the ocean receives at its surface, and by the comparatively high temperature of this latter (the surface) in those regions where evaporation is the most active. Comte d'Archiac, in his compendium of the Physics of the Globe (Vol. 1 of his Histoire des Progrès de la Géologie) has the following observations:—" Les recherches faites sur la composition des eaux recueillies en mer pendant le voyage de la corvette *La Bonite*, ont démontré que dans l'Océan Atlantique, le Golfe du Bengale, l'Océan Indien, et l'Océan Atlantique Méridonale, la densité generale de l'eau prise à la surface était moindre que celle de l'eau prise à une certaine profondeur. Une seule exception à cette règle a été reconnue. A une seule exception près aussi, le degré de salure est plus prononcé au fond [I suppose he means at considerable depths, not absolutely at the bottom] qu' à la surface."‡ This view is in accordance, I believe, with the usually received opinion.§ From all that I have read and thought upon the subject, it appears to me that in the phenomenon of the, so to say, reversed inequalities of temperature between the surface and deep water in the intertropical and polar regions, we have the main cause of oceanic movements. With all this, however, I do not mean to infer that the principle announced by you is to be wholly disregarded, in our attempts to frame a satisfactory hypothesis respecting the object of the saltness of the sea. In striving to uphold my own theory, I have done so, perhaps, in too exclusive a spirit.

With regard to the origin of the saline components of sea-water, you adopt, I perceive, the views of the elder Darwin and others, to the effect that these components have been entirely despoiled from the land, by springs and rivers, and so carried into the deep, the action continually going on. But here, again, you must allow me to differ from you. My reasons for this dissent are the following,—First, the striking preponderance of chloride of sodium over the other salts in sea-water; whereas, amongst the saline matters generally present in river-water, it by no means occupies a very conspicuous place. But even if the sea were fed by brine springs instead of rivers, my argument would still hold good; for in nine cases certainly out of every ten, these brine springs would be but returning to the ocean, what, in former geological epochs, the ocean had rendered to the land. Fownes's assertion, quoted in your note at page 179,* appears to me to be altogether untenable, or at least without true bearings on the point at issue. Lakes, so peculiarly conditioned as these of which he speaks, have evidently not been rendered salt (in the common acceptation of the term) by the rivers which flow into them, but have been salt from the beginning—as portions of ancient seas cut off from the main ocean by geological changes. Secondly, according to this view, the sea at one time must have been far less salt than at present, and have gradually become salter and salter—an inference, the assumption of which is scarcely warranted on palæontological data.†

This objection might be met, however, by assuming that marine life was created, as a compensating agent, so soon as the sea attained to its present saltness, and not before. I place, therefore, no great stress upon it.

Finally, may we not legitimately seek to ascertain why chloride

* And we may add that of marine vegetation also. Dr. Lyon Playfair was, I believe, the first to suggest the action of Algæ in abstracting carbonic acid from the water, and thus setting free the carbonate of lime.—E. C.

† " The vapor is taken from the surface water: the surface water thereby becomes more salt, and consequently heavier; it therefore sinks; and hence we have due to the salts of the sea, a vertical circulation, viz., a descent of heavier—because salter and cooler—water from the surface, and an ascent of water that is lighter—because it is not so salt—from the depths below."—Lieut. Maury; *Wind and Current Charts*, 6th ed. p. 182. This view has been entertained, however, by other observers. Thus, Sir Charles Lyell, in his " Principles of Geology," has the following remarks in reference to the Mediterranean —" After evaporation, the surface water becomes impregnated with a slight excess of salt, and, its specific gravity being thus increased, it instantly falls to the bottom, while lighter water rises to the top, &c." But here we have to consider, how far this surface water could sink without yielding a portion of its extra salt to the surrounding water, and so rendering the whole uniform. I question altogether the probability of a vertical descent of this kind taking place in ordinary seas, at least to any depth. Over broad areas, moreover, it would necessarily be subject to frequent and often loug-continued interruptions.—E. C.

‡ " The results of the chemical examination of samples of sea-water collected during the voyage of the corvette *La Bonite*, have shown, that, in the Pacific Ocean, the Gulf of Bengal, the Indian Ocean, and the South Atlantic, the general density of water taken from the surface was *less* than that taken from a certain depth. Only a single exception to this law was noticed. With little more than a single exception, also, the degree of saltness was greater at great depths than at the surface." See also *comp. rend.*, vol. vi., p. 616, from which the above is quoted.—E. C.

§ Theoretically, the surface water, owing to evaporation, should be slightly cooler than the stratum of water immediately below it. I allude, of course, to warm and temperate seas.—E. C.

* " The case of the sea," says Fownes, " is what occurs in every lake into which rivers flow, but from which there is no outlet except by evaporation. Such a lake is invariably a salt lake. It is impossible that it can be otherwise; and it is curious to observe that this condition disappears when an artificial outlet is produced for the waters."—*Lieut. Maury*. To this I reply, that, owing to the comparatively small amount of chloride of sodium in ordinary river waters, a lake of this kind, if originally fresh, would become silted up by deposition of carbonate of lime, &c., long before it could possibly exhibit the composition of the ocean. An originally salt lake would necessarily become fresh in course of time, if river waters were constantly poured into it, and an outlet also provided by lower levels to the sea. If we place at three different levels, an empty vessel, a vessel containing a salt solution, and one filled with ordinary water, this latter occupying the highest level, and connect the three by strips of filtering paper, or a few cotton threads to act as syphons, the contents of the middle vessel (here representing the salt lake) will be gradually replaced by the water from above, and transferred to the under vessel. Where no outlet is provided, local conditions, on the other hand, as in the case of the Dead Sea, may modify to a marked extent the original composition of the water.—E. C.

† I am quite aware that the study of Fossil Ichthyology offers some slight support to the view mentioned in the text; but this, at the best of doubtful acceptation, is completely outbalanced, on the other hand, if we take into consideration the immense numbers of radiated animals, brachiopods, cephalopods, and other types which preceded fish-life, and which were undoubtedly marine.—E. C.

of sodium should have been chosen by Divine wisdom in preference to other salts, as the chief constituent of the solid matter of the sea. Apart from its manifold economic applications, I feel assured that some abstract principle is involved in its selection. I have been trying to devise some experiments to elucidate this, but hitherto without success. May not, however, the primary cause of its selection lie in the extremely slight variation which it exhibits in regard to its solubility in water of very different temperatures?

Trusting that you will look upon these observations, as they are meant, in the light of a friendly interchange of opinion,

I am, dear Sir, most truly yours,

EDWD. J. CHAPMAN.

University College, Toronto, Canada West,
April 3d, 1855.

The Unity of the Human Race.

The question of the unity and common origin of mankind, with the consequent opinions as to the human race consisting of only one, or of several species, promise, from various causes, to become one of the most prominent scientific problems of our day. The descent of all mankind from a single pair, has indeed until recently been considered, if not as an established point, as one scarcely open to dispute. The teachings of Scripture, and especially the Mosaic narrative of creation, were supposed to affirm this with an explicitness which scarcely admitted of discussion. The progress of inquiry, however, in various directions, leading to very remarkable and unforseen conclusions relative to the creation and extinction of species, and the geographical distribution of plants and animals, has revived inquiry in regard to the tenability of the opinion that mankind consists only of a single species, descended from one pair. The interest in the conclusions to which it may lead, has, moreover, been considerably extended throughout the American Continent by the peculiar circumstances under which different varieties of the human family are here associated together; though it may perhaps admit of question, how far the prejudices of cast, and the motives of self-interest, or political bias, leave the American of the United States open to the impartial investigation of this important inquiry.

The most recent work devoted to this subject, is the "Types of Mankind," issued only last year from the Philadelphia Press, by Dr. J. C. Nott, and Geo. R. Gliddon, Esq., but embracing contributions from various distinguished American savans, and one of special interest furnished by Professor Agassiz. The last of these contributions has excited renewed attention at the present moment, owing to peculiar circumstances. The vacancy of the Chair of Natural History in the University of Edinburgh, occasioned by the lamented death of Professor Edward Forbes,—noticed in a recent number of the *Canadian Journal*,—has induced some influential men in the Scottish capital to name Professor Agassiz as one peculiarly fitted in many ways to occupy the room of that distinguished naturalist and palæontologist. The consequence, however, of the first movements, made with a view to recommending this appointment to the officers of the Crown, who are the patrons of the Chair, has been to excite a keen controversy as to the compatibility of the views entertained and advocated by Professor Agassiz, with the responsible trust of an educational appointment in one of the national Universities. "We have no fear," says one writer, "that the Bible rightly interpreted, and the discoveries of Science rightly and thoroughly investigated and defined, will ever be found to clash; because we believe that they are equally, although through different channels, a revelation of the same Deity. But we do believe, and greatly fear, that crude and imperfect speculations, carried on by an ingenious and clever man, such as Agassiz is, in presence of ingenuous and ardent youths, may unsettle the faith of many, and effect a world of mischief."

We are rather inclined to believe that greater credit is attached to the influence of scientific teaching in producing the scepticism prevailing among some portion of the students of science, than a more rigid investigation of the premises would be found to justify. Sceptical men of science have indeed not unfrequently made use of their science to defend their scepticism, but we are not aware of even one solitary instance which can be produced in which science, even when misinterpreted, has made a sceptic of a believer. Truth need not fear inquiry; and in this question of the unity or plurality of the human species, as in all others, now that it has been broached, the greater latitude there is allowed to free inquiry and discussion, the sooner will its ultimate decision be recognised to be in harmony with Revelation, when rightly interpreted. It is a manifest injustice, however, to speak of the cautiously expressed views of Professor Agassiz as "crude and imperfect speculations;" or to represent him as a sceptic, because of his thus exercising the right of private judgment in relation to scientific research. On this subject Dr. Horatio R. Storer, of Boston, an American Physician temporarily resident in Edinburgh, supplies the following interesting information, in a letter addressed to one of the newspapers of that city, relative both to the opinions and domestic habits of the distinguished American Naturalist:—

"For several years a pupil of his, and for a longer time sharing largely the privilege of intimate acquaintance, I may be allowed to state, that, so far from being an irreligious man, or expressing opinions that, if properly investigated, would prove him an unbeliever, Professor Agassiz is at once an earnest and enthusiastic inquirer into the hidden mysteries of past and present life, and a very devout Christian—a believer in the revelation of God through His Word, as in those He has made through his works.

"Into the merits of the question of man's identity of origin, this is not the place to enter; to properly discuss the arguments that have been brought forward on either side would require many pages and hours. The advocates of several centres of birth and subsequent divergence thence, have only claimed that like those of geology as now by all received, yet so lately condemned as overturning Scripture, they but render certain evidence given by nature, and otherwise unintelligible, subservient to, and explanatory of, the teachings of the Mosaic record. And, besides, diversity of *origin* by no means implies diversity of *species*, nor is it so used.

"Never have I heard Agassiz say one word implying, nor do I believe he holds, that any tribe or variety of man, however degraded, whether black or not, has not a living soul, capable, under favourable circumstances, of indefinite development, and of becoming fitted for the Christian's heaven.

"Among other courses of popular lectures delivered by him, many of which have been repeated in various parts of America, and most fully attended, was one several years since upon "The Plan of the Creation." No one could have heard this course, either in whole or in part, without a quickened faith in the Almighty, All-wise, All-loving Creator.

"His religious views are very strong and decided. The circumstances of his early life in Switzerland could indeed but have rendered them so, his father having been a clergyman, and, I think, of Lutheran tenets. That father's old friend, now or lately pastor of a German Church in New Orleans, followed the son to America, devotedly attached to him, and for a long time was his domestic chaplain. Those quaint and fervent home religious services, at which I have been present, are still vividly before me."

But the interest attaching to this discussion involves much more than the character or religious belief of any single scientific enquirer, and it may not be uninteresting to the readers of the *Canadian Journal*, to peruse the following abstract of an article published recently in *The Scotsman* and which from the initials C. M. attached to it, is no doubt from the pen of Charles Maclaren, F.R.S.E., long the talented editor of that journal, and now well known among the scientific geologists of the Scottish capital. The article is expressly written to refute the arguments advanced by a member of the Edinburgh corporation, in proof of the disqualification for a chair in a Scottish University of any one venturing to entertain a doubt as to the unity of the human race; and further to show that the doubt referred to is less novel or startling than unscientific readers may be aware of.

Referring to the arguments of this civic censor, the writer observes :—

"He seems to me to consider the question respecting the *unity* of the human race as one that had never been agitated till Agassiz published the memoir referred to. I thought it had been universally known that, from the days of Aristotle downward, opinions have been divided upon the subject; that, while some maintained that the white, black, yellow, and red men were distinct species, the progeny of distinct *primitive* pairs, others held that they were merely varieties of one species, and all sprung from a single pair. Buffon, the great authority of the last century, believed in the unity of the human race; but, in deference to those who embraced an opposite opinion, thought it necessary to argue the question, not on theological, but on physiological grounds. Cuvier, the founder of scientific zoology, came to the same conclusion, but apparently with hesitation, and on the narrow ground that mulattoes and other human hybrids have offspring like themselves, while among the lower animals mongrels were supposed to be universally barren. He does not say that the human species *is* single, but "*would appear to be* single, since the mingled progeny of all the individuals composing it is fecund."* And the learned translator, Dr. Carpenter, informs us, in a note, that Cuvier's argument rests on a sandy foundation, for that some hybrid animals are fruitful.

In 1825, Bory St. Vincent, a far-travelled naturalist, and editor of the "Dictionnaire Classique d'Histoire Naturelle," published *L'Homme, Essai Zoologique sur le genre Humain*, in which he maintained that the human race embraces fifteen different species, derived from as many primitive pairs. The book, in two volumes, has run through three editions at least. In the following year a work appeared on the same subject in one volume by M. Desmoulins, an anatomist (Histoire Naturelle des Races Humaines), who divides mankind into *sixteen* distinct species."

It is therefore apparent, that Agassiz is by no means the first who has broached the opinion that mankind does not consist of one, but of several species; nor did the doubt it implies, which, when first broached, presents so repulsive an aspect to many good men, deter the learned and pious Dr. John Pye Smith from giving the inquiry an impartial critical review in his work on "The relation between the Holy Scriptures and some parts of Geological Science." Note E of that work contains a "dissertation on the varieties of the Human Species," in which the learned divine remarks :

"'It would be wrong to conceal the difficulties with which the subject is surrounded, however satisfied we may be with the evidence in favour of the descent of all mankind from one original pair of ancestors.' To the unscientific reader these difficulties may appear to be far-fetched novelties of modern scepticism, but inquiry proves them to be as little novel as baseless. They were felt by writers in very ancient times; as appears from a targum, or old Jewish paraphrase, of Genesis ii. 7, quoted by Dr. Pye Smith, in which it is explained that God created man *red, black, and white.*

"Dr. Smith admits that the action of the solar light and heat in tropical climates only produces various shades of brown, but 'we have no instance of a white family or community acquiring the proper negro colour;' nor of a negro family becoming of a healthy European white, except by intermarriages. This permanence of the white and black complexions suggests another difficulty. 'The recent explorings of the Egyptian tombs and temples have brought to light pictures of native Egyptians, and of men and women of other nations, comprising *negroes*, who are distinguished by their characteristic form of face and their *completely black* colour. Some of these highly interesting representations are proved to be of the age of Joseph and earlier, and some in which the negro figures occur are of the eighth century after the flood. Assuming, then, that the complexion of Noah's family was what I have ventured to suppose as the normal brown, *there was not time for a negro race to be produced* by the operation of all the causes of change with which we are acquainted.' Who, indeed, will believe that a Spaniard transplanted to Guinea would become a negro in twenty-four generations? The force of the objection is vastly increased when we refer to the history of the Berbers, Tibboos, and Tuaricks, all speaking the same radical language, and spread over the oases of the Sahara, from Morocco to Egypt, who have lived under the same burning sun with the blacks since the time of Herodotus (2300 years), and are only *brown*—no more negroes than the Moors or Egyptians.

"Adam might be the first created man, the protoplast of the race, a fair representative of all its qualities, without being literally the father of all mankind. 'Mr. Edward King, a zealous Christian,' says Dr. Smith, 'strenuously maintained the opinion of the plurality of human ancestry.' The illustrious Dr. Arnold of Rugby also held that 'the physiological question was not settled.' 'Nor can we affirm it to be an impossibility that the Almighty Creator should have seen fit to bring originally into being duplicates, triplicates, or other multiples of pairs, formed so alike that there should be no specific difference between them.'

"With regard to Acts xvii. 26, it cannot be proved that 'one blood' necessarily signifies descent from a common ancestry; for, admitting a specific identity, though having proceeded from distinct foci of creation, both the physical and mental characteristics would be the same in all essential qualities.

"'But if we carry our concessions to the very last point—*if* the progress of investigation should indeed bring out such kinds and degrees of evidence as shall rightfully turn the scale in favour of the hypothesis that there are several races of mankind, each having originated in a different pair of ancestors—what would be the consequence to our highest interests, as rational, accountable, and immortal beings? Would our *faith*, the fountain of motives for love and obedience to God, virtuous self-government, and universal justice and kindness—would this faith, 'the substance of things hoped for, the evidence of things not seen,' sustain any detriment, after, by due meditation and prayer, we had surmounted the first shock? Let us survey those consequences.

"'If the two first inhabitants of Eden were the progenitors, not of all human beings, but only of the race whence sprung the Hebrew family, still it would remain the fact, that *all* were formed by the immediate power of God, and all their circumstances, stated or implied in the Scriptures, would remain the same as to moral and practical purposes.

"'Adam would be 'a figure of Him that was to come' the Saviour of mankind; just as Melchizedek, or Moses, or Aaron, or David. The spiritual lesson will be the same.

"'The sinful character of all the tribes of men, and the individuals composing them, would remain determined by the most abundant and and painfully demonstrated proofs, in the history of all times and nations. The way and manner in which moral corruption has thus infected all men, under their several heads of primeval ancestry, would be an inscrutable mystery (which *it is now*); but the need of divine mercy and the duty to seek it would be the same; the same necessity would exist of a Saviour, a redemption, and a renovation of the internal character by efficacious grace.

"'That the Saviour was, in his human nature, a descendant of Adam, would not militate against his being a proper Redeemer for all the races of mankind, any more than his being a descendant of Abraham, Judah, and David, at all diminishes his perfection to save us, 'sinners of the Gentiles.'

"'Some difficulties in the Scripture-history would be taken away; such as—the sons of Adam obtaining wives not their own sisters;—Cain's acquiring instruments of husbandry, which must have been furnished by miracle immediately from God upon the usual suppositi-

* "Quoique l'espece humaine *paraisse* unique, puisque tous les individus peuvent se mêler indistinctment, et produire des individus feconds," &c.

tion;—his apprehensions of summary punishment: 'any man that findeth me will slay me';—his fleeing into another region, of which Josephus so understands the text as to affirm that Cain obtained confederates and became a plunderer and robber, implying the existence of a population beyond his own family;—and his building a 'city,' a considerable collection of habitations.

"'Thus, if contrarily to all reasonable probability, this great question should ever be determined in the way opposite to what we now think the verdict of truth, the highest interests of man will not be affected.'

"If then Agassiz adopts the idea that the human family has a plurality of ancestors, it is evident that he holds it in common with learned, pious, and good men, and it is plain that the doctrine would not have disqualified him in Dr. Pye Smith's estimation for any chair of Natural History."

These observations offer a fair summary of the arguments which present themselves to the mind of an earnest and thoughtful inquirer in reference to this extremely difficult question. The simple declaration addressed by St. Paul to the assembled Athenians, that God has "made of one blood all nations of men to dwell on the face of the earth," has been produced as conclusive; but a more rigorous criticism compels the Christian student of science to admit that the interpretation of it, as meaning strictly a universal descent of every human being from one common pair of ancestors, is not necessarily the logical deduction from that beautiful and significant passage. The writer on this vexed question, whose remarks we have specially referred to above, concludes by observing:

"One would think that the folly of attempting to settle physical questions in this way has been sufficiently exposed already. When Galileo affirmed that the earth turned on its axis, and revolved in an orbit round the sun, the Inquisition met him with texts of Scripture, denounced him as a heretic for his glorious discoveries, and put him in prison. What intelligent Catholic would not be delighted if these disgraceful proceedings could be blotted from the annals of his Church? How firmly was it believed, in very recent times, that all the existing species of land animals came out of Noah's ark; and how reluctant were many religious men, taking the words of Moses *au pied de la lettre*, to receive the new and sound doctrine that every great region of the world has animals peculiar to itself, and that there must have been many distinct centres of creation. When geologists first announced the vast age of the earth, and that its creation, instead of being completed in six days, extended over millions of years, texts of Scripture were again appealed to to put them down, and great was the outcry. The progress of science has been retarded, not arrested, by these proceedings, and have they not brought obloquy upon religion?"

The circumstances to which we have referred above, as calling special attention, at the present time, to this question of the Unity of the Human Race, cannot fail to give an additional interest to it in the minds of all who sympathise in the progress of science; and will abundantly justify us, we feel assured, in the estimation of our readers, for thus bringing it under their notice. At the same time, we are fully alive to the many difficulties with which the inquiry is beset, and to the deeply founded nature of all the preconceived ideas with which it seems to come into collision; and we might have hesitated to introduce the discussion in our pages, had it been characterised by a less reverential recognition of the sacred narrative, in all that relates to the origin and the destiny of man.

Report on the Results of the different Methods of Treatment pursued in Epidemic Cholera.*

This report is restricted to an analysis and statistical records placed in the possession of its authors, and supplied from the various metropolitan hospitals and medical practitioners, such deductions only being made from the results of their analysis as are plain and unequivocal.

2,749 cases of cholera are selected, of which 1,194 occurred in the metropolitan hospitals, 1,645 in the metropolitan districts (not in the hospitals), and the remainder in the provinces.

The treatment of the disease is divided into four heads:—1, the alterative mode of treatment; 2, the astringent; 3, the stimulant; and 4, the eliminant (or cathartic). The alterative and astringent modes are, according to medical writers, based on the theory that the specific poison of cholera attacks the mucous lining of the intestinal canal and sets up an action which provokes an exhausting effusion of the serum of the blood. The eliminative treatment obviously presupposes the necessity of assisting nature to get rid of the *virus*, her attempts to effect which object constitute, according to this theory, the leading symptoms of the disease. The alterative treatment includes the administration of calomel, in small doses at short intervals, and in larger doses at longer intervals, with or without emetics, salines, external stimulants, icewater, hot baths, injections into the veins, clysters, and sometimes opium (with calomel). The "astringents" consist of sulphuric acid (dilut.), chalk and opium, alum, salines, cinchona, gallic acid, quinine, and some of the remedies indicated under the "alterative" system. The "stimulants" administered under the third mode of treatment include ammonia, calomel, brandy, turpentine enemata, ether, opium, nitrous oxyde, camphor, and chloroform, with external stimulants, emetics, and hot baths, the "cordial tonic mixture," cajeput oil, icewater, salines, &c. The "eliminants," prescribed under the fourth head, were castor oil, with and without emetics, external stimulants and hot baths, calomel, capsicum, ginger, &c., emetics, ipecacuanha in small doses, olive oil, and the potass. tartr. of antimony. Many of these remedies are common to the various classes of treatment, such as the mineral acids, calomel, opium, and others. Out of the hospitals, chloric ether, soda, and mineral acids were prescribed under the first head (in addition to the other remedies); catechu, acetate of lead, tincture of the sesqui chloride of iron, logwood, and sugar, under the second, or astringent mode; chloroform, capsicum, creosote, &c., under the stimulant course of treatment; and croton oil under the fourth or cathartic.

And now for the result of this great experiment. The evidence of a carefully-prepared series of tables, set forth in the report, condemns altogether, as a principle of practice, the fourth, or eliminant, mode of treatment; it testifies against the stimulant principle, excepting as a resource in extreme cases; it displays a decided advantage in the alterative principle; especially as carried out by calomel and opium; and it shows a still superior advantage in the astringent principle, as applied through the medium of chalk and opium. The percentage of deaths was as follows:—viz., under the eliminant mode, 71.7; under the stimulant, 54; under the alternative (calomel and opium),36.2; and under the astringents (chalk and opium), only 20.3 per cent. These statistics are tested by the relative proportion which the cases of collapse bear to the number of deaths of their own classes respectively. Calomel and opium stand highest in the scale of success, if this criterion be adopted, the order of preference

* Addressed to the President of the General Board of Health by the "Treatment Committee of the Medical Council." Presented to both Houses of Parliament by command of her Majesty.—*Even. Mail.*

being thus, viz. :—Calomel and opium, 59.2 per cent.; calomel (in large doses), 60.9; salines, 62.9; chalk and opium, 63.2; calomel (small doses), 73.9; castor oil, 77.6; and sulphuric acid, 78.9 per cent. The superior success of calomel and opium in severer cases thus appears a distinct fact elicited by the present inquiry. The relative advantages of the other modes of treatment mark calomel in small doses, castor oil, and sulphuric acid as actually to be deprecated in severer cases.

Chalk and opium stand at the head of the list in the general percentage, both in hospitals and private practice, but in the comparison of the collapse cases with the number of deaths the average declined to the fourth rank.

The success of various modes of treatment in the hospitals follows the same ratio as those in private practice. The greater mortality in hospitals is to be accounted for by the greater severity of the cases, and the poverty and previous exposure of the patients.

In the 1,100 cases in the hospitals 643 had emetics at the outset, of whom 410 had collapse, 140 consecutive fever, and 344 died; 457 cases were treated without emetics, of which 303 had collapse, 106 consecutive fever, and 226 died; out of 1,100 cases 102 had turpentine enemata administered. Of these 87 had collapse, and 59 died. Of 998 treated without turpentine 626 had collapse, and 511 died. Of 496 cases in which icewater was given 404 had collapse, and 248 died; and of 604 cases in which icewater was not given 309 had collapse and 322 died.

No definite information has been obtained on the subject of "consecutive fever," and of the statistics afforded no use can be made. This defect, however, need be the less deplored, since cholera, in the form of consecutive fever, becomes analogous to other fevers, the treatment of which is, or ought to be, generally understood.

It is to be regretted that the returns are almost silent on the very important topic of simple and choleraic diarrhœa passing into cholera. Some statistical tables are given, but the number of cases treated is so small, compared with the whole, that no fair inference can be drawn as to the comparative success of the various modes of treatment, nor do the reported facts warrant any specific induction. It is hoped that this most important branch of the statistics of cholera may receive the careful attention of the medical profession when they furnish future returns.

As regards the cases of simple and choleraic diarrhœa, which have not passed into cholera, it is shown, by a series of statements, that the astringent plan of treatment is decidedly to be preferred in the early stages of the disease, or in premonitory diarrhœa. The order of the percentage of failure to stay the disease in its earlier stages, or in that of premonitory diarrhœa, is as follows:—Salines, 13.6; chalk mixture, 8.9; calomel (with opium), 6,9; calomel, 2.4; chalk, with opium, calomel, and astringents, 1.5; sulphuric acid, with opium and calomel, 1.3; chalk, with opium, ammonia, and catechu, 0.2; sulphuric acid, with and without opium, and with calomel as an adjunctive remedy, 1.33; and chalk, with and without opium, together with aromatic confection and ammonia, with catechu, kino, logwood, and calomel as an adjunctive remedy, 1.31. Including the deaths from diarrhœa as failures, the percentage of failure is as follows, viz.:—Chalk mixture, 12.6; calomel and opium, 7.1; opium, 2.6; chalk, with opium, calomel, and astringents, 1.7; sulphuric acid, with opium and calomel, 1.5; and with opium alone, 0.3; sulphuric acid, with and without opium, and with calomel as an injunctive remedy, 1.54; and chalk, with or without opium, together with aromatic confection and ammonia, with catechu, kino, logwood, and calomel as adjunctive, 1.55.

The Committee of the Medical Council conclude their report by expressing an opinion that, although these and other facts throw a most useful light on the comparative value of different modes of treatment, still more decisive evidence might be obtained under more favourable circumstances. The inquiry was not undertaken till the epidemic had nearly reached its culminating point, and when leisure for pre-arrangement was wholly wanting. They entertain a conviction, which has grown with the progress of the work, that by insuring fuller and more numerous returns to a more complete and distinct form of inquiry, they would, on any future visitation of the disease, be enabled to collect ample store of available facts, and to deduce truths of the utmost importance both to guide medical practice and to enlighten science.

On the recent Cold Weather, and on the Crystals of Snow observed during its continuance.*

BY JAMES GLAISHER.

(*Read before the Meteorological Society, London, March 27.*)

The present year was ushered in with a high temperature, exceeding its average by quantities varying from 8° to 12° daily. On January 10th a cold period set in, together with a dense fog; and the temperature, which was as high as 49°·6 on the 9th, fell to 26° on the 10th. This diminution of temperature was accompanied by a change in the wind, which, from blowing a compound from the west, changed to a compound from the east; and, with few exceptions, has so continued up to the present time, as shewn by the returns published in the *Daily News*. On January 12th and 13th the temperature was about its average value; but after the 14th, when the cold set in, its departures were very considerable, particularly over the south-west and eastern parts of England. Scotland and the northern counties were frequently exempt from any share in the great severity of the period, which was also less severely felt at the sea-side than at inland places. The lowest temperature, viz., 0°·8, took place at Berkhampstead. At different places in England, on different days, it was as low as 3°, 5°, 7°, and 10°. For a similar period to the one which has just passed, it is necessary to go back to the year 1814. That year, however, commenced with a very low temperature—a frost having set in on December 26th, 1813. The intensity of the two periods was about the same. It ended, in 1814, on March 21st; whereas, with the exception of a short intermission about the first week in March, the temperature of the present period has descended lower and more frequently than it did in 1814, in which year the coldest day was on January 10th, when the reading was 19°·6. The lowest temperature of this year also occurred in January, and was 19°·2. In 1814 the lowest temperature in February was on the 4th, and was 22°. The lowest reading in this month of the present year was 20°·6, and took place on the 18th; and this February was a much more severe month than the February of 1814. The mean temperature of February, 1814, was 32°·4; and that of the present year was 29°·3. The remarkable feature of the late severe weather has been the peculiar character and continuous fall of snow; which first made its appearance on January 16th, and laid on the ground from that date till the end of February.

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* Athenæum.

The average amount did not at any one time exceed a foot in depth; and its density has been of from 8 to 10 inches of fresh fallen to 1 inch of water, which its melting has produced. The drifts have varied from 5 feet to 10 feet. The snow this year has been of that kind which former writers have designated "Polar snow"—it having been chiefly composed of crystallized particles of compound figure, which they supposed to be confined, with rare exceptions, to the Arctic regions. This supposition, however, is not supported by the great prevalence this year of innumerable crystals, which have exhibited a degree of crystalline formation equal to any that have been recorded as seen in colder latitudes. They have been very generally distributed, and, whilst prevalent, attracted a considerable share of public attention. The primary figure or base of each crystal was either a star of six radii or a plane hexagon. The compound varieties included combinations of spiculæ, prisms, and laminæ, clustered upon and around the radii, and seem, in their various stages of formation, and almost endless variety, to defy any attempt to classify or arrange them into groups. At the commencement of the frost simple stellar forms were very prevalent, and fell in clusters of from 10 to 20 in a group, with a temperature at or about the freezing point. They were observed to fall both during a profound calm, with gusts and hard wind, and frequently unaccompanied with snow. On examination through a Coddington lens, they were found to be composed of transparent spiculæ, from which diverged other spiculæ set upon the main radii of the figure at an angle of 60°. A great number of plane hexagons fell on the morning of February the 8th. Some of these were of transparent laminæ, beautifully marked with successive and inner tracings. As the morning advanced, they became intermixed with others, set round with solid hexagons, which continued to fall until an hour before noon. For half an hour after several large crystals, of compound figure, fell with the snow. Their centre or nucleus was similar to the compound hexagons of the morning, from which diverged radii laden on either side with prisms, each set on at an angle of 60°. From this time till 4 o'clock few crystals were observed to fall; but after 4 o'clock, innumerable crystals, of arborescent form, were discernible. The nucleus of the greater number was a plane hexagon marked with inner parallel tracings, from which sprung radii, each of which intersected a crystalline formation very similar in appearance to the pinnæ of the Lady Fern. As the evening advanced, these became less prevalent, and were mingled with almost every variety which had previously fallen during the day. Snow continued to fall till late at night, when it lay upon the ground to the depth of 8 inches. The day will long be remembered as one of the most keen and inclement of the wintry period under discussion. The minimum of the preceding night had been 29°·8; and throughout the day, the temperature never rose higher than 32°. Snow fell, without intermission, from early morning till late at night. It was accompanied by a piercing wind; and in the afternoon, when the arborescent form again set in, it was blowing quite a storm. Traffic on the railways was for a time suspended, and the day was one of bitter and intense cold. When, says Mr. Glaisher, I went out, at long past midnight, the snow sparkled everywhere with crystals, as granite sparkles with the grains of mica; every leaf, cobweb, knotty projection and sheltered nook bore its burden of drifted snow and glistening crystals. It was a night to be remembered, for the extreme loneliness of Nature arrayed in her most wintry garb. A large number of crystals fell on the mornings of February 13th, 16th, and 17th. Some, and the great number of them, were arborescent, in different stages of formation, with three large alternating, with three small pinnæ, studded with prisms and spiculæ, extending on either side of the principal radii. Some exhibited an appearance, towards the end of each pinna, like a tuft of bended leaves, with serrated edges, beautifully white and seemingly opaque. Mr. Glaisher accounts for this appearance by the passage of the crystal in its descent through different regions of the atmosphere, in some one of which it has become partially thawed, and again frozen, in which condition it has been received on the surface of the earth. This conjecture is the more probable as the jagged and serrated appearance is often attendant upon the first thawing of these bodies on entering a temperature above the freezing point. The opaque and white appearance is communicated by a subsequent formation of granulated particles of snow, in all probability attaching to it, whilst in a transition state, in its descent to the earth. This is, however, only a surmise in the absence of any better solution of the fact. On February the 21st, with a temperature of 20°, there fell for an hour, unaccompanied by snow, a great variety of intensely beautiful and complicated figures. The radii were encrusted with solids, both of rhomboidal and irregular shape, cut into many facets, and heaped one upon the other. On this morning there were numerous double crystals, that is, two crystals united by an axis, at right angles to the plane of each. They generally fell with their radii intermediate, and the radii of the upper somewhat projected beyond the radii of the under crystal. Two days after, that is, on February 23rd, the frost gave way; but for some few hours in the morning Mr. Glaisher was able to continue his observations. The morning was overcast and calm, and snow fell in flakes, accompanied by minute spiculæ. Soon after 9 o'clock a change took place, and, mingled with the heavy flakes, there fell a large number of thick snowy crystals. On examining these with a Coddington lens, they were found to consist of an assemblage of prisms, grouped in thick arrangement, and bristling up (if the phrase may be allowed), at all angles, from some invisible nucleus. Some of the prisms were longer than others, but most of them were notched here and there, giving indications of the formation of other prisms or spiculæ. The longer prisms were midway in character between the prisms of high crystalline formation and the ordinary spiculæ. After the lapse of half-an-hour, the common flakes were fewer in number, and were accompanied with innumerable spiculæ. These did not fall separately, but in groups of several, clinging to each other at all angles. They had a fleecy appearance to the naked eye, but under the glass were long and rounded prisms, partaking much of the character of an icicle; but all notched and tapering to a point. At this time the air was soft and mild, and the snow was falling thickly. At 10*h.* 30*min.* the air was still calm, and the snow continued. At this time it was easy to detect here and there pinnules in an intermediate stage of formation. The spiculæ, which were still falling, were now of greater length, and their figure more perfectly developed. At 11*h.* crystals were falling, of great beauty and transparency, but of simple figure. They were thin and transparent in the highest degree, and bore a leafy appearance. Very many of them were double. Whilst observing them they changed their figure in the most curious and kaleidoscopic manner possible, the upper groups of prisms collapsing first, the next in order next, and so on,—the collapsing each time dissolving three or more prisms into one, a change effected with instantaneous rapidity. This was the first step preparatory to their dissolving; the next step was the rounding of every angle that remained; and the next step to that the extension and thickening of spiculæ, which had

served as axes to prisms, and which now derived accession from their half-fluid and dissolving matter. In this manner they continued to exchange one simple form for another yet more simple, until the pristine drop of water occupied the site of the former crystal. At 11*h.* 15*min.* snow was falling quickly in minute crystals as described. The air was genial and mild, the clouds lightened as preparatory to sunshine, and the birds for awhile sang joyously. All nature seemed to rejoice in the mitigation of the weather. At 12*h.* the snow had all but ceased, and the temperature was 37°. The cocks crowed as anticipating a change; the birds answered each other from the trees; icicles, two feet in length, which had been noticed for sixteen days previously, began fast to melt away. All nature, but the birds, was still; and, what is rarely seen, the trees were dripping moisture while the snow lay like a rime upon their branches and bended stems. At 1*h.* 13*m.* the temperature was 35°.5, and small and fine snow was again falling; water was dripping everywhere, the birds were singing joyously, and the calm continued. After a short intermission, the cold set in again, but with much abated rigour; and on the mornings of March 8, 9, and 10, with a temperature a few degrees above the freezing-point, Mr. Glaisher observed a number of stellar crystals, made up almost entirely of spiculæ and half-dissolving prisms. They were between 0.3 in. and 0.4 in diameter; they fell sparingly, without snow, sometimes singly, but more often in groups of three or four together. The collapsing, which would seem to be a method of change peculiar to a temperature below freezing, was not witnessed on this day; but the process of dissolving at a temperature above 32° was seen to great perfection. The outer and boundary line of each figure, and its component parts, became exchanged for curved lines, bending inwards, whilst the crystalline matter, every instant becoming more watery, ran out at the angles of the prisms in the form of spiculæ. The prisms of the crystals, thus in a transition state to their original fluid medium, presented each an exact similitude to a holly leaf, and as being made up of curved lines a very anomalous appearance. This change was not always simultaneous, sometimes commencing at either or both ends of the radii. There is room for much examination and study respecting the manner of the dissolving of these bodies, which under some circumstances would doubtless show a reversal of the conditions under which they were originally formed and attained their compound figure.

The author next proceeded to give a brief summary of each day's observations. On Feb. 8, they commenced with a temperature of 29°, which subsequently increased to 32°, at which the temperature continued for many hours. During the whole of this time, conspicuous for its uniform temperature, the prevailing figure of the crystals continued to change, until towards the close of the day they fell mingled together in the greatest profusion. In the early part of the morning, it will be remembered that they were arborescent; that these forms suddenly ceased, and were exchanged for hexagons; that these again became the centre of a more complicated arrangement; that after a time these diminished in numbers, when the arborescent form again prevailed, and finally a mingling of nearly all that had previously fallen. On Feb. 16, with a temperature of 26°, there were two distinct orders of crystals, those which were arborescent and exhibited an intermediate formation, and those of cruciform character, of solid hexagons cut into numerous facets. Feb. 17, with a temperature of 32° throughout, exhibited figures, it will be remembered, composed of elongated prisms, ranged parallel to each other, and of very similar character. There were, however, exceptional instances of the prevailing character of Feb. 16. On Feb. 21, with the lowest temperature, viz. 20°, the figures were singularly compound, and departed more than on any previous day from the figure of the regular hexagon. On Feb. 23, the last day of the frost, there were a large number of aborescent crystals of one common character, and which never ceased collapsing into more and more simple figures. On March 8, after a week's respite, the cold set in again. The crystals on this and the next two consecutive days, were of a very distinctive class, of purely stellar figure, and composed chiefly of fine spiculæ. From these observations it would seem, that however temperature may affect these bodies, it is more than likely that other conditions of a different nature are involved in their first formation. This, apparently, was the view taken by a writer on the subject in the *Phil. Trans.* for 1672. Speaking of snow crystals (says the Rev. G. Langwith), "It is not easy to determine whether these figures may not be the result of the chemical components of the atmosphere, which as they preponderate may not under certain conditions of temperature give rise to these curiously simple and compounded bodies. Dr. Smallwood, of Isle Jesus, Canada East, imagines them to be intimately connected with the electrical states of the atmosphere, whether negative or positive. The foregoing observations show a wide difference between the various orders of crystalline formation, and it would seem from them that the greater the degree of cold the greater the departure from the simple star, with all its variously arranged spiculæ: also that shortly after the descent of a crystal, at any temperature below the freezing point, various processes of change take place, which are evidently an undoing, if not a reversal, of the operations which had assisted in their formation. These changes, through which every crystal never fails to pass, even at temperatures very many degrees below the freezing point, each more destructive than the last of its crystalline and compound figure, led the author to the same conclusions. The subject of snow crystals has engaged the attention of Aristotle, Descartes, Grew, Kepler, Dr. Nettes, Dr. Scoresby, and others, but like most subjects of meteorological inquiry, it has languished for want of extended and continuous observation. The published information concerning them is, however, likely soon to derive accession from Sir Edward Belcher's observations made in the Arctic Seas. Coming from this experienced and able officer, they will be of substantial benefit to the inquiry into the nature and circumstances of formation of these interesting bodies

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The Geological Survey of Canada.*

The Report of the Select Committee on the Geological Survey of Canada is a very important and valuable document, and we lose no time in presenting the main features of the Report before the readers of the *Canadian Journal.*

The minutes of evidence occupy above sixty pages of royal octavo, and contain much useful and curious information, mingled, of course, with matter irrelevant or detrimental to the purposes of the enquiry.

We confine ourselves, in the present instance, to the Report itself, proposing to advert to the evidence in the next number of the *Journal.*

* Report of Select Committee on the Geological Survey of Canada. Printed by order of the Legislative Assembly. 1855.

ABSTRACT OF THE REPORT.

Since the first commencement in 1843, Mr. Logan and his assistants have traversed and examined every part of Canada, from Gaspé to the head of Lake Superior, in the uninhabited portions, following, for the most part, the course of the Lakes, the St. Lawrence, and the Ottawa, and their principal affluents, and in the settled parts penetrating farther into the interior.

The minuteness with which the exploration of this immense tract of country has been conducted, has varied very much according to circumstances, as the means of access, the immediate requirements of the country, and the interest and importance of the formations under examination. In some cases, where the geological structure maintains an uniform character over large areas, as on the north side of Lake Ontario, little more has been done than to trace the boundary between the principal formations. In others, as on Lakes Superior and Huron, in the upper part of the Ottawa country, and in Gaspé, the nature of the country, and the entire absence of reliable topographical surveys, rendered any other examination impossible in a limited time, except to trace the course of the principal streams, with such occasional excursions into the interior, as the geological observations seemed to dictate; whilst in some, where the facilities were greater, and the field more inviting, considerable minuteness has been attained, as in the region between Lakes Huron, Erie, and Ontario, the country between the St. Lawrence and the Ottawa, and some parts of Lower Canada, south of the St. Lawrence. The result has been such, as to enable Mr. Logan to lay down with sufficient certainty the general geological features of the whole of Canada, and to fill up many of the more interesting parts in considerable detail.

From the absence of accurate maps, Mr. Logan and his assistants have, in almost all cases, been obliged to conduct a topographical survey, as well as an examination of the strata; a fact which should not be lost sight of, as having materially retarded the progress of the survey, but which, at the same time, has been of great use to the Province, in giving certain information as to rarely visited localities, and even in correcting erroneous surveys in settled parts of the country, as is acknowledged by Mr. Russell, of the Crown Lands department, in his evidence, who bears testimony to the great accuracy of some of Mr. Logan's surveys

During these investigations many new fossils and mineral forms have been discovered, and new facts of great interest to geologists have been brought to light; amongst the latter may be mentioned the crustacean tracts discovered by Mr. Logan in the Potsdam Sandstone;* the chemical composition of certain fossil and recent shells, which had hitherto been thought exclusively to distinguish the skeletons of vertebrate animals; the parallelism of the disturbing forces throughout the Silurian, Devonian, and Carboniferous eras; and more particularly, the researches on the metamorphism of rocks, which seem to establish with certainty, that not only the crystalline formation of the great Apalachian chain, but also the still older rocks which separate the St. Lawrence from the Arctic Ocean, are merely stratified sedimentary deposits in an altered condition.

Of more immediate practical interest is the knowledge gained of the mineral wealth of our country. Besides building materials of all kinds, and limestone, the discovery of which in some parts is of as much practical value as that of gold itself, there is the copper of Lakes Huron and Superior, the slates, marbles, serpentines, soapstones, and iron and copper ores of the mineral region south of the St. Lawrence, and the magnetic iron ores of the Laurentine formation, of greater extent and value than exist probably in the rest of the known world.

Upon the whole, with the single exception of coal, the Canadas, on the testimony of Professor Hall, have been shown to stand higher in respect of their mineral products than any of the surrounding states. All these and numerous other economic materials, a list of which is given in the report of 1849, 1850, and the description of the London Exhibition of 1851, if not actually first discovered by the survey, have been made generally known, the formations which yield them pointed out, and in many instances the localities, where they can be profitably worked, indicated.

Whilst the survey was in progress, a very large collection of specimens has been brought together, with the intention of illustrating, not only the science of Canadian geology, but its practical application in the supply of useful materials, the whole of which are now deposited at the house of the survey at Montreal.

Such is the present result of the Canadian Geological Survey, and although much remains to be done, considering the vast extent of country under examination, the difficulties presented by the uninhabited state of much of it, the total absence of reliable topographical maps, and the short period of each year which our climate renders available for the field work, your Committee think they may pronounce with confidence, that in no part of the world has there been a more valuable contribution to geological science for such a small outlay (hardly more than £20,000 in all). In confirmation of this opinion your Committee would refer to the letter of Professor Agassiz, and the evidence of Professor Hall, and to the opinions of scientific men quoted by Mr. Logan and Mr. Hunt. They beg also to add two other quotations, as showing the estimation in which our survey is held by men of science in England and France. "In Canada especially, there has been proceeding for some years one of the most extensive and important Geological Surveys now going on in the world. The enthusiasm and disinterestedness of a thoroughly qualified and judicious observer, Mr. Logan, whose name will ever stand high in the roll of votaries of his favorite science, have conferred upon this great work a wide-spread fame."—*London Quarterly Review*, October, 1854.

"De toutes les colonies Anglaises, le Canada est celle dont l'exposition est la plus intéressante et la plus complète, on peut même dire qu'elle est supérieure à l'exposition minérale de toutes les contrées qui ont envoyé des produits à Londres; cette supériorité vient de ce qu'elle a été faite d'une manière systématique; il en résulte que son examen fournit des moyens d'apprécier à la fois la constitution géologique et les ressources minérales du Canada. Cette circonstance vient de ce que notre collègue, M. Logan, qui remplit dans le Canada, les fonctions de *Geological Surveyor*, a présidé sur les lieux aux choix de la plupart des échantillons qui ont été envoyés à l'exposition, et qu'il les a classés depuis leur arrivée à Londres."—*M. Dufrenoy, membre de l'institut,* in the Jury Reports of the London Exhibition.

It is mortifying to your Committee to have to report, that results of so much value are almost inaccessible to the public, and that a great proportion of the inhabitants of Canada, if not ignorant of the existence of the survey, are at least unacquainted with what it has achieved. The annual reports are presented to Parliament, and buried in the Journals of the House, except a few hundred copies, which are distributed by Members amongst

* This is a mistake which should not have occurred; the real discoverer being the late Mr. Abraham, of the *Montreal Gazette*. Mr. Logan mentions this fact in his Report for 1851-52, page 10.

their friends, so that the reports of two consecutive years rarely fall into the same hands. As a further proof of the ignorance which prevails as to what has already been done, your Committee may mention, that the existence of a combustible material, closely resembling coal, in the rock at Quebec, which has lately occupied so much attention, is fully described, and the reasons why there is small probability of its being profitably worked given at large in the report of 1844, pp. 19 and 20.—These facts speak for themselves as to the necessity of republishing the reports in some shape.

Another serious deficiency is the want of a map. Not only are the annual topographical measurements of the survey unknown, till the publisher of some new map obtains copies of them, but it is extremely difficult to follow a geological description without a map, and a student must colour one for himself from the reports, before he can get a clear knowledge of the geological features of the country.

Again, there are many things which even the reports do not contain, were they accessible, viz: plates and descriptions of new and characteristic fossils, sections and illustrations of the disturbances of the strata, &c., without which a complete understanding of the subject cannot be obtained. We may mention also generalizations, and theoretical conclusions, deduced, not from the report of one season's work, but from a comparison of the whole, such as the investigations upon the metamorphic rocks already mentioned, which must be sought for in a perfect form in the papers communicated by Messrs. Logan and Hunt to the scientific bodies of Europe and the United States.

Lastly, the vast collection of minerals accumulated at Montreal, from insufficiency of funds to provide for their proper arrangement, lie in a great measure buried in packing cases in the vaults and sheds of the Survey Office.

With a view to remedying these deficiencies, your Committee would recommend the immediate republication of the substance of all the former reports. The course which your Committee recommend, would be, to publish all that is necessary of the old reports, revising, re-arranging, and if necessary adding to them, so as to give a connected and systematic view of the geology of the Province, as far as it is at present known. This volume, which would not be a very large one, should be accompanied by a coloured geological map of the whole Province, upon a scale of from 20 to 25 miles to the inch, and should be illustrated with a few wood cuts of the most characteristic fossils, and, the most common crystalline forms of minerals, with plates of such geological sections as may be requisite to elucidate the subject, and, if necessary, with maps on a larger scale of particular localities, which may require more minuteness of detail to exhibit their structure, or the occurrence of mineral veins. There should also be a copious index of the localities reported upon, and another of economic materials, with a reference to the body of the work, where a fuller description of them and their geological relations, and geographical distribution, would be found.

The publication of the annual reports of future progress should continue as heretofore, with the addition of such wood cuts, sections, and detailed maps, as might be judged necessary to elucidate the report in an uniform shape with the volume above mentioned, to which they would, in fact, become an annual Appendix. In order to secure this uniformity, as the annual reports would be published by the House, and form part of the journals, the revised reports, though not on the journals, should be published in the same form.

Your Committee would also recommend the publication, in numbers, from time to time, as materials accumulate, of plates of new and characteristic fossils, with letter-press descriptions, together with such other illustrations, sections, &c., as may be thought of scientific value, but not of a nature to accompany the reports as above mentioned.

The importance of an accurate geological acquaintance with the country is so universally acknowledged, that it is unnecessary to do more than point out some portions of the evidence, which shew the immediate practical results; but as an apparent misapprehension exists in some quarters as to the objects of such a national undertaking, your Committee may be pardoned for making some additional observations. The discovery of valuable economic materials speaks for itself, although, even here it may be doubted, whether the relative importance of the minerals indicated is always justly appreciated, whether the crystalline limestones of the Laurentian series have not been of more real value, than some discoveries of a far more imposing character. But where the outline of some formation of no very obvious economic use is accurately traced for many miles, when minute and laborious investigations are carried on of the undulations, contortions and disturbances of other strata, with exact measures of their thickness and dip, and when the greatest attention is paid to the fossils they contain, some people are apt to think that the Geologist might be more usefully employed. They draw a distinction between practical utility and scientific interest. The ultimate object, however, of all science is practical utility; it is only a systematic, instead of a desultory search for valuable facts. The discovery of some useful material at a particular point would be an isolated fact though perhaps of great importance to that locality; but combined with a correct scientific knowledge of the geology of the country, it would be not only available over an extensive region, but would be the contribution of a valuable truth to the whole world. Instances of this intimate connection between science and economics will be found in the evidence.

Again different individuals, according to their several pursuits, expect information of a special nature from the Geological department. The agriculturist wishes to have every bed of marl pointed out, and an analysis of every soil; the architect or engineer calls for details of accessible building stone, brick-clay, and hydraulic lime; while the miner wants information of where mineral veins occur, the abundance of the ores, their chemical constituents, and the per centage of metal. Now, details of this description for the whole country cannot be expected, especially where it is to such an extent uncleared. The duties of persons engaged in a Provincial Survey is to ascertain and make known with such accuracy and detail as is practicable, the physical structure of the country; to record the localities where any valuable material has been observed, with its probable extent, and the direction in which its recurrence may be expected, and in the case of mineral veins, to describe their character as far as visible, the apparent richness and abundance of the ores, and the indications which the country exhibits of the frequent occurrence of the lodes. They cannot point out every bed of marl or brick-clay, or pause to search out every promise of a mine, or still more the probability of its being worked to commercial advantage. The practical details must, of necessity, be left to private enterprise to accomplish. No appropriation by Parliament, no staff of geologists, however extensive, would suffice for the whole Province, if more were expected. The public should provide general information for all; the individuals who are to turn it to their private profit, must supply the rest.

In conclusion, your committee beg leave to submit the fol-

lowing summary of their recommendations, with an estimate of the annual expenditure, which would be required to put them in practice.

1. The republication of not less than 20,000 copies of the revised reports, with a coloured map. The expense of this is already provided for by the additional appropriation of £2000 in the estimates of last year.

2. The publication of the same number of the annual reports of future years uniformly with the above.

3. The periodical publication of 3000 copies of plates and descriptions of fossils, &c.

4. The gratuitous distribution of the two former as follows: Four copies to each Member of the Legislature, copies to the Governments of all British Colonies, and the East India Company, for distribution by them to public libraries and Scientific institutions, and one copy to every University, College, Literary and Scientific Society, Mechanics' Institute, Library Association, Grammar, Normal and Model School, Municipal and Common School Library in this Province, applying for the same, and to the principal learned Societies in the United States and Europe. The gratuitous distribution of the latter to be confined to one copy to each member of the Legislature, the copies to Municipal and Common School Libraries to be omitted, and the number sent to British Colonies and foreign Societies proportionately restricted. The remainder, after keeping some on hand for parties subsequently added to the gratuitous list, to be for sale at cost price.

5. The establishment and maintenance of the Museum and Library upon an efficient footing.

6. To provide for the supply of Geological and Mineralogical specimens to other Museums.

7. The employment of topographical surveyors and their parties, to assist in the Geological Surveys, when judged necessary.

8. The employment of two or three additional explorers.

9. The employment of a Resident Assistant, as keeper of the Museum, and in the general business of the office.

10. The employment of a Second Assistant Geologist, charged more especially with the exploration of mineral localities. The Committee wish it to be understood that in the present state of the country they consider this the least essential addition to the establishment, and unless ample funds are provided, they would not advise it, to the prejudice of any other of their recommendations.

11. The encouragement of voluntary assistance by the publication of questions and short instructions how and what to observe and collect.

12. Securing the aid of Deputy Provincial Surveyors, and requiring all persons admitted as Surveyors for the future, to pass an examination in the rudiments of Geology.

13. The establishment of certain points in different parts of the country, as a basis from which local surveys may be reckoned.

14. Requiring all Railway Companies to furnish plans and sections of their surveys.

Estimated Annual Cost of the Department as Compared with the Present Expenditure.

	Present.	Future.
Salary of Director of Survey	£555	£555
" of Assistant Geologist	333	400
" of Chemist and Mineralogist	300	400
" of Resident Assistant		200
Explorers	120	450
Field expenses of two Surveys	600	600
Topographical Surveyors and their parties		750
Publications of fossils, sections, &c., including services of a Palæontologist		800
Laboratory	100	100
Museum		200
Books, Instruments, &c.		200
Fuel, Messenger, and incidental expenses	275	345
	£2,283	£5,000
Assistant more particularly charged with examination of mineral veins and his field expenses,		1,000
		£6,000

The whole nevertheless, respectfully submitted.

JOHN LANGTON, Chairman.

Committee Room, Legislative Assembly,
29th March, 1855.

On the Durability of Railroad Iron.

BY WILLIAM TRURAN, ESQ.

The duration of the iron rails of our great railroads is a subject of vast importance to all interested in the maintenance and extension of railway communication. In all estimates for new roads for thinly settled districts, the cost of the iron rails figures as the most prominent item; and even in the thinly settled States of Europe, where the metal is obtained at a comparatively cheap rate, the cost of the rails forms no inconsiderable portion of the whole expense of construction. On the first introduction of railroads, it was confidently asserted by their promoters, that the iron rails would last for an indefinite period. A few months working, however, demonstrated, that although manufactured from the best metal, iron railway bars were subject to lamination and disintegration from the repeated rolling of heavy loads. Their duration, in numerous cases, did not exceed two or three years, and in no instance of a raiload having a heavy traffic, have the rails remained sound and in working condition for more than 14 years. On some of the earliest constructed lines in England, the rails have been changed twice and even three times within twenty years. Opportunities have, therefore, presented themselves to the engineers of such lines, of ascertaining the actual traffic which iron rails are capable of withstanding under different circumstances.—But if note has been taken of the facts relating to rails, which have been taken up, it is to be sincerly regretted that they have not been recorded in one of the numerous scientific publications of Europe or this country. Their publication would be of the greatest benefit to railroad companies, and, eventually, would be of essential service to engineers and scientific men generally.

The traffic which rails of ordinary quality are capable of bearing, will depend on circumstances; but where the conditions are of a favorable nature, and the bars themselves perfectly sound, it will not fall far short of twenty millions of tons. But, although rails will stand the rolling of this traffic, those which are daily observed in a dilapidated state on numerous railways, have not, in the majority of cases, carried the one-fourth of this traffic; and immense quantities of rails have doubtlessly been renewed before they have borne the one-tenth of this weight. Well recorded observations are wanted on this head, and pending the publication of more extended observations, the writer would direct attention to the following observed cases of rails, which have stood the carriage of several millions of tons under very disadvantageous circumstances.

It may be necessary to state, that the rails used in every case, but the last, were of the usual quality, (those in case 2 are a portion of the bars manufactured for the Moscow and St. Petersburgh Railway.) They were manufactured in a manner commonly pursued at Welsh rolling mills, and were, in point of quality and appearance, equal to any manufactured or in use in Europe. The rails in the Hirwain road were rolled from inferior metal, and were not in other respects, well manufactured.

It may be necessary also, to mention in this place, that the gross weight of the trains is given in every instance.—This, it is believed, is perferable to giving the weight of the freight and omitting the weight of the engine and cars, which may be unnecessarily heavy or light for the loads which they convey.

CASE 1.—Railroad for the conveyance of minerals, near Merthyr Tydfil, Wales, length, 2 miles; gauge, 4 feet 8·5 inches. This line is

a gradient of 2 inches rise in the chain through its whole length, and contains curves so low as 3 chains radius. The wagons employed weigh 3 tons 12 cwts. when empty, and 7 tons 1 cwt. when loaded. They are mounted on 4 cast iron wheels, 30 inches in diameter, keyed fast on the axles, and have outside bearing brasses, but neither buffer, draw nor bearing springs. The motive power consists of locomotive engines weighing from 14 to 16 tons each exclusive of tender. The rate of hauling ranges from 10 to 16 miles an hour.

This line was originally laid in a very temporary manner, with bridge rails 2·5 inches high, 2 inches wide at the top or bearing part, and 6 inches at the foot; and weighing 36 lbs. per yard lineal. They were fastened by spikes through the flanches to cross sleepers, 6 inches by 4 inches, by 6 feet long, at intervals of 4 feet. The ballasting consisted of the clay and peaty soil excavated from the side drains, and distributed in a layer one foot thick under the sleepers.

After two years' wear, with the engines and wagons described above, the original rails were laminated to an extent that rendered their renewal a matter of necessity. The gross traffic that passed over them during that period, amounted to 1,822,800 tons. Had these rails been supported by larger sleepers at shorter intervals, and these sleepers packed up by proper ballasting, they would have stood the wear and tear of from twice or three times the above quantity of traffic.

Case 2.—The railroad previously described, was relaid with T rails 3·75 inches high, 2·5 inches wide at the head, and 3·5 inches broad at the foot; and they weighed 63 pounds per lineal yard. The small sleepers were replaced by others, averaging 9 inches wide, by 9 feet long, at the reduced distance of 3 feet apart from centre to centre. The rails were also supported on shallow cast iron chairs, which were spiked to the sleepers, and the clay ballasting was strengthened by the addition of a thick layer of broken stones. The new rails with the altered mode of laying, have now been in use ten years, during which period the gross traffic over them has been 9,710,000 tons.

The height of these rails when new, was 3·75 inches, as previously stated, but by wear and abrasion from the rolling of the above weight, their height has been reduced to 3·63 inches. Taken collectively, these rails have endured very well, and with the exception of a very few crushed and bruised bars, which will require immediate renewal, they will, probably continue fit for the traffic for at least three years again. Hence their duration may be estimated as equal to the movement of 12,600,000 tons.

To show the ill effects which must result from inattention to the state of the sleepers, at different places on the line, a sleeper was permitted to remain without support. After a lapse of a few days, the rails immediately over the slackened sleepers, were found crushed and flattened for a length of 6 or 7 inches, so as to reduce the depth of the bar from 3·63 to 3·2 inches. Similar results followed, when the distance between any two sleepers was increased to more than 4·5 feet; thus showing the necessity of having, under the rails, a firm and rigid support at very short intervals, to prevent as far as possible all injurious deflection.

In those rails which have broken down, either from lamination, or during the foregoing experiments, the impropriety of using any other than puddled iron in the top surface of the rail was fully displayed. These rail bars were manufactured from piles of the ordinary quality and description, with a top plate of the so-called "best iron," one inch in thickness. This plate in the course of rolling was reduced in thickness, to 16 of an inch in the finished bar. Now, all the lamination which has yet been discovered, has occurred with this superfical coating of "best iron," which has often pealed off, in long narrow strips or splinters, of several feet in length.

Case 3.—Mineral railroad, consisting of a steep incline plane of the 4 feet 8. 5 inches guage, with a double track of rails, each 480 yards long, and falling 6·7 feet per chain.—The direction of the traffic being downwards, this portion is worked by the gravity of the descending full wagons, which are made to draw up the empties, by means of ropes, working over rope rolls and friction drums, revolving on gudgeons at the incline top. The rails were of the bridge pattern, 2. 5 inches high, 2 inches wide at top, 6 inches broad at the foot and weighed 57 pounds per yard. They were supported on flat cast metal chairs, which were spiked to transverse sleepers of 8 inches wide, by 8 feet long, placed 3 feet apart.—Under the sleepers, there was a thin stratum of clayey soil as ballast.

The wagons described in case 1, roll over this section, also at velocities averaging 12 miles per hour. The rails on this section were in use for eleven years, during which time the traffic over them amounted to 8,087,000 tons, equal to 4,043,500 tons over each track. The injury which results to the rails from the absence of adequate support under the sleepers was manifest in this case, and undoubtedly was the means of shortening their duration fully one-half.

While forming another mineral railroad, crossing under this section, it became necessary to evacuate an opening, 10 yards wide, over which the rails were carried by four pieces of pine timber; one being placed under the centre of each rail bar. The deflection of the beams by the passing of the loaded wagons, was from 2·5 to 3 inches, and from this cause alone, the whole of the rails on these pine stringers were battered and laminated so as to require renewal in the short space of two months, and after they had borne a traffic of no more than 61,300 tons.

Case 4.—Mineral railroad, on a dead level throughout, consisting of a single track bridge rails, the same as those described in case 1, but spiked directly to sleepers, averaging 6 inches wide, by 6· 5 feet long, placed 3 feet apart on broken limestone, as ballasting. The wagons previously described, work over this section also, but the motive power being horses, the rate of travelling rarely exceeds three miles an hour. The rails on this section have now been in use 11 years, have borne a traffic of nearly 4,900,000 tons, and with the renewal of the wood-work of the line, will probably last for a similar period, and for the passage of an equal quantity of traffic. Their duration may, therefore, be assumed to be equal to the transport of 9,800,000 tons.

From the foregoing examples it will be seen, that while bridge rails, weighing 56 pounds per yard, were destroyed with the passage of 1,822,800 tons, hauled at a velocity of 12 to 16 miles an hour, by locomotive engine, weighing from 14 to 16 tons each; with the same wagons, but at the reduced speed of 12 miles an hour, they have stood under the passage of 4,033,500 tons; and with the same wagons, but at the still further reduced speed of 3 miles an hour, they have stood the wear and tear from the passage of 4,900,000 tons, without material injury.

Case 5.—Railroad for the conveyance of coal, consisting of an inclined plane, falling 7 inches per yard, forming a double track of rails of the 4 feet 8·5 inches guage, 400 yards long, and worked by stationary steam power at top, through the medium of ropes and drums. The rails are of the inverted U pattern or Evans' patent, weight 90 lbs. per yard, were 3·4 inches high, 2. 74 inches wide at the head, 4 inches wide at the foot, rolled in lengths of 15 feet, and supported at intervals of 3·5 feet, by cast iron chairs resting on massive blocks of limestone.

Each track of rails is traversed by a single wagon, mounted on four cast iron wheels, 2 feet diameter, keyed on wrought iron axles, and revolving in brass fitted plummer blocks bolted to the frame work of the wagon. The weight of the wagon when empty is 7 tons 2 cwts., when full 13 tons 16 cwts., and it is drawn at an average speed of 8 miles an hour.

These rails have now been in use seventeen years, and the gross traffic which has passed up and down the plane, amounts to 11,016,000 tons, or 5,508,000 tons over each track. The result of this traffic has been to reduce the height of the rails from wear and abrasion, from 3·4 to 3·26 inches.—In other respects they are in good condition, and will probably sustain a further traffic of 3,500,000 tons, making their duration equal to 8,000,000 tons.

Case 6.—Railroad for the conveyance of limestone, a single track 2 1-2 miles long, worked by horse power. The rails were of the fish-bellied section, 5 inches high, 2 inches wide at the head, and .75 inches thickness of centre web, weighed 55 pounds per yard, and were laid in in cast iron chairs resting at intervals of 3.5 feet on limestone blocks of from 2 1-2 to 3 cwts. each.

The wagons, which were made wholly of wrought or cast iron, weighed, when light, 1 ton 19 cwts., and when loaded, 8 tons 10 cwts. each. The wheels were 2 feet 6 inches in diameter, and turned loosely on the axles, which were bolted to the under side of the carriage.

These rails stood for nine years with an average annual traffic of 180,960 tons, or a gross total of 1,628,640 tons, when they were replaced by stronger bars.

Case 7.—Railroad consisting of an inclined plane, with a double track of rails raising 9.7 feet per chain forward. Rails of the bridge pattern, weighing 56 pounds per yard, 2.375 inches wide at head, and 5.625 inches at the foot; spiked directly to cross sleepers 9 inches wide, by 9 feet long, at distances of 3 feet 3 inches apart. The sleepers repose on a thick deposit of broken scoria, from the blast furnace in the neighborhood, which is found to be an excellent material for ballasting the permanent way of railroads.

The wagons running on this road are of wrought iron, mounted on 4 cast iron wheels, 30 inches in diameter, turning loosely on their axles, and are without springs of any kind. They weigh when light, 1 ton 8 cwts., and when loaded, 4 tons 16 cwts.; and are drawn by

stationary steam power acting through drums and chains, at an average speed of 6 miles an hour.

These rails have been in use thirteen years, and appear but very little the worse for the traffic which has passed over them. This has amounted to a gross weight of 7,840,000 tons, or 3,920,000 tons over each track. Their duration may be fairly estimated at twice this weight, or 7,840,000 tons over each track of rails.

Case 8.—Railroads for the conveyance of goods, metals, and minerals, consisting of a single track of rails of the bridge pattern, weighing 75 pounds per yard, 2.5 inches high, 2 inches wide at head, and 6 inches at base, laid in shallow cast iron chairs, which are spiked to sleepers 9 inches wide, by 7 feet long, placed at distances of 3.5 feet apart.

The wagons travelling over this road are of various patterns, and are, with a few exceptions, devoid of springs.—Their weight, when empty, varies from 26 to 63 cwts., and when loaded, from 6 to 11 tons. The speed at which they are drawn varies, also, from 3 miles an hour, the speed of those drawn by horses, to 12 miles an hour, for those drawn by steam locomotive engines.

These rails have had the wear and tear from the passage of 4,783,000 tons of miscellaneous traffic, but from their damaged condition, we cannot estimate their duration at more than 5,500,000 tons.

Case 9.—Railroad for the conveyance of coal, consisting of a single track of parallel rails, weighing 40 pounds per yard, 3.87 inches high, 1.87 inches wide at the head, 1.2 inches wide at base, with centre web .56 inch thick, laid in cast iron chairs pegged to stone blocks, weighing from 4 to 6 cwts. each, and placed at an average distance of 3 feet apart from centre to centre.

The wagons running on this road are drawn by horses at an average speed of 4 miles per hour, and are mounted on four cast iron wheels, 28 inches in diameter, turning loosely on their axles, which are bolted to the wrought iron frame of the wagon. They weigh, when empty, 3 tons, and when loaded, 5 tons 17 cwts.

The gross traffic over this line has amounted, during the 13 years which it has been open, to 8,626,000 tons, and it now remains in a good working condition. The duration of these rails may, therefore, be estimated at about 15,000,000 tons.

Case 10.—Taff Vale Railroad, for the conveyance of passengers, metals, minerals and general merchandize, between Cardiff and Merthyr Tydfil. Upper section consisting of a single track of parallel rails of a single head form, weighing 50 pounds per yard, 4.5 inches high, 2.2 inches wide at head, 2 inches width of lower web, and .66 inch thickness of centre rib or web, supported at intervals of 3 feet by chairs bolted to cross sleepers 10 inches wide by 9 feet long. The ballasting under the sleepers consists of a thick stratum of broken cinders.

The wagons and carriages running on this road, vary considerably in their weight—from 2 tons 10 cwts. to 4 tons 10 cwts, when light, and from 8 tons to 12 tons when loaded. They are furnished with wrought iron wheels and tyres, bearing springs and friction brakes, and the passenger carriages have buffer and draw springs. The locomotive engines employed, weigh about 20 tons, exclusive of tenders and work at speeds varying from 15 miles per hour, for slow mineral trains, to 30 miles an hour for passengers.

These rails have been in use nearly 13 years, and from the most careful computations, the traffic over them has been 5,400,000 tons. At the crossing and portions of the line where a considerable braking power is applied, their depth is reduced by abrasion, to 4.4 inches, but in all other respects these rails are generally sound. Their duration may be estimated as equal to the rolling of 10,000,000 tons.

Case 11.—Taff Vale Railroad—the down-line from the Aberdare junction to Cardiff. Length of the line, 14 miles, and falls at the rate of 15 feet per mile. Rails of the parallel double headed section; depth, 5 inches; width of head and foot, 2.5 inches; centre web, .75 inch thick; weight, 72 lbs. per yard. They are supported at intervals of 2 feet 9 inches by cast iron chairs firmly bolted to cross sleepers, 10 inches wide by 9 feet long. In all other respects, the formation of this road is similar to that of the upper section near Merhyr Tydfil.

The carriages and engines last described, work on this section also, and at similar speeds. It is traversed daily by 3 passenger, 1 mail, and numerous luggage, metal, mineral and merchandize trains. The passenger trains average about 96 tons gross each, but the mineral and other trains sometimes exceed 1000 tons in weight.

From the annual traffic returns of this company, we find that in the eight years that these rails have been laid, the gross traffic which has rolled over them, amounts to 20,516,000 tons. Although this weight has caused considerable lamination and abrasion at the stations and on the sharpest curves, those rails are now in fair working order, and with attention to the sleepers and ballasting, they will last for the conveyance of as much more. Hence their duration may be estimated as equal to the rolling of 41,000,000 tons.

Case 12.—Taff Vale Railroad—the up-line from the shipping port of Cardiff to the Aberdare junction. This line is of the same length, and is similar in its construction to the down line, with which it runs parallel throughout. It is traversed, also, by the same engines and and carriages, but the coal and coke wagons pass over this line empty.

The rails are of the same date as those of the down line, and the gross weight which has rolled over them, amounts to 11,200,000 tons. Their general condition is very similar to those in the down line; and their duration may be estimated as equal to the passage of an additional weight of 11,200,000 tons, or a gross total of 22,400,000 tons. The greater weight traversing the down line, is owing to the large quantities of coal sent down for shipment; the wagons used in the conveyance of of which return empty over the up line to the collieries.

The rails on both sections having suffered nearly alike in lamination and abrasion, although one has sustained little more than half the rolling of the other, is accounted for by the cicumstance of the gradient being just sufficient to enable the engines and loaded wagons to roll down the one line, while on the other the ascent with 90 or 100 empty wagons is accomplished with difficulty by engines having 18 inch cylinders. The abrasion and injury to the rails by the slipping of the engine wheels in ascending gradients, is probably equal to, if it does not exceed, that from the rolling of the traffic.

Case 13.—Railroad for the conveyance of minerals to the Hirwain Iron Works, consisting of a single track, 3 miles long, of the 4 feet 8.5 inch guage. Rails, of a parallel single head form, 4.25 inches deep, 2.5 inches wide at the head and .75 inch thickness of centre web. They weigh 46 lbs. per yard, and are screwed fast to single cheek chairs on massive stone blocks every 4 feet. The ballasting consists of blast furnace cinders, and dust from the coke yard.

The carriages are constructed of wrought and cast iron frames, and are mounted on 4 cast iron wheels 32 inches diameter, turning loosely on axles bolted firmly to the carriage frame. They weigh when light 2 tons 5 cwts., and when loaded, 5 tons, but are unprovided with any springs. The locomotive engines weigh 10 tons each when in running order and propel the loaded carriages at an average speed of 10 miles an hour.

This road has been laid with these rails about 4 years.—The gross weight which has passed over it in that time amounts to 1,055,000 tons. On carefully examining the state of the rails after this traffic, 23 per cent. were found laminated to an extent rendering their immediate replacement by sound rails indispensable; while the others cannot, under existing circumstances, last more than 2 years again. The duration, then, of the rails on this road may be estimated as equal to the passage of 1,318,000 tons, or considerably less than either of the previous examples.

In reference to the foregoing examples of the duration of railway bars under different conditions of laying and working, we may remark that in every instance where, in the construction of the permanent way, sufficient solidity has not been obtained by the employment of adequate sleepers, the destruction of the rails has been most rapid. This was the result with cases 1 and 6, and the effects are visible in 3, 4, 5, and 8. The greater duration of 11 and 12 over the others, must be ascribed to the use of heavy rails, wagons and carriages with bearing springs, and a well constructed and carefully maintained permanent way. No. 12 is a very favorable instance of durability—probably, equal to any ever laid, which has principally resulted from the very favorable grade of the line. No. 10, with heavier rails, would have equalled No. 11, as the conditions are otherwise similar.—The absence of bearing springs to all wagons, except those in cases 10, 11 and 12, must also have had a very prejudical effect on the rails and greatly lessened their duration.—In case 6 the rails were too weak, and the support unequal to the heavy wagons employed. Case 9, with heavier blocks and lighter wagons, is a very favorable specimen of a mineral railroad. Case 13 shows the most unfavorable results of the whole number detailed, but when the very inferior quality of the metal used and the defective nature of the fastening employed is fully considered, a different result could scarcely be expected.

In the tabular statement of the duration of the rails, it is supposed that the cost of labor and materials in replacing unsound bars and the ultimate expenses incidental to the entire renewal of the rails, when worn out, will be equivalent to the value of the old metal obtained. This is found to agree very nearly with the results obtained in practice.

We have in our possession, similar notes respecting the duration of cast iron rails, of which numerous examples may be seen at or in the

neighborhood of Merthy Tydfil; but the general abandonment of this material for that of wrought iron, would cause such notes of little value, if published.

Tabular Statement of the Duration of Iron Railroad Bars.

Number of case or example.	Weight of rail, in pounds, per yard.	Depth of rail in inches.	Bearing surface, presented by sleepers for each lineal foot of track, in superficial feet.	Greatest weight rolling on four wheels, in tons.	Greatest weight on a foot lineal of track, in tons.	Velocity of trains in mls. per hour.	Motive power employed.	Gross traffic over a single track of rails before renewal, in tons.	Weight of rails per mile for a single track, in tons.	Cost of rails per mile, estimated at 50 dollars per ton.	Number of tons carried over one mile of road for each dollar's worth of iron consumed.
1	56	2·5	·75	16	2·7	16	Locomotive	1,822,800	88	4400	414
2	63	3·75	2·25	16	2·7	16	Locomotive	12,000,000	99	4950	2424
3	56	2·5	1·75	7	1·2	12	Gravity	4,043,500	88	4400	919
4	56	2·5	1·1	7	1·2	3	Horses	9,800,000	88	4400	2227
5	90	3·4	1·7	14	2	8	Stationary	8,000,000	142	7100	1126
6	55	5·	1·1	8·5	2·2	3	Horses	1,628,640	86	4300	378
7	56	2·37	2·1	4·8	1·5	6	Stationary	7,840,000	88	4400	1781
8	75	2·5	1·5	11	2·4	12	Locomotive	5,500,000	117	5850	940
9	40	3·87	2·5	5·9	1·3	4	Horses	15,000,000	63	3150	4126
10	50	4·5	2·5	16	2·8	30	Locomotive	10,000,000	78	3900	2564
11	72	5·	2·7	16	2·8	30	Locomotive	41,000,000	113	5650	7256
12	72	5·	2·7	16	2·8	30	Locomotive	22,400,000	113	5650	3964
13	46	4·25	2·	10	2·1	10	Locomotive	1,318,000	72	3600	363

Discovery of Ancient Greek Sculpture.

Letters from Athens mention the discovery of 300 antique statues, or fragments of sculpture, recently brought to light by excavations at Argos, on the site of the Temple of Juno. These precious remains of ancient art have been recovered by the Greek Government; and, if it had any large spirit or interest in archæology, Argos possesses within its classic soil quarries of invaluable works of sculpture buried in the ruins of the ancient city, and which might be reclaimed at no great cost. Indeed, the sites of the old Greek temples in many districts, excavated by the Government or by the capital of associations, would probably, by sale of the works discovered, amply repay the outlay. We have evidence of value received in the voluntary and enterprising exertions of our own countrymen, Sir Charles Fellowes and Mr. Layard, and in the produce of the rival labours of M. Botta and M. de Sauley, under the auspices of the French Government. The small village of Argo stands on the ruins of the ancient Argos. The old town is described by Strabo as the principal city of Peloponnesus next to Sparta. In number and magnificence of temples and public edifices, in schools of art and great artists, it perhaps only yielded the palm to Athens. In sculpture the Sicyonico-Argive school, under Polycletus, rivaled the attic studios of Phidias and Praxiteles. Pausanias, in his description of the temples, statues, and paintings remaining in Greece, when about A. D. 177 he travelled throughout all its States, describes the classic relics with the detail and accuracy of a *Murray's Handbook*, and devotes several pages to the remains of Argos in his time. The temples and their inestimable works of art were then generally complete and perfect. Their marbles and casts of metal were of priceless value, comprising many statues in marble and brass by Lysippus and other eminent sculptors, besides the works of local artists. The Temple of Juno, in its architecture and riches of art, competed with the Parthenon. The Roman generals, the barbarians, and the pirates we know plundered the Greek cities, both before and after the visit of Pausanias. Nevertheless, the great bulk of treasures escaped, the majority of the "Temples of God" being preserved from sacrilege out of regard for the common sentiment of religion and the faith of the conquered races. Rome, Florence, and Naples, and private collections on the continent and in England doubtless contain many first-class works of Greek sculpture; but the mass, probably, remains, whole or fragmentary, beneath the ruins of their ancient resting places. Indeed, the Elgin Marbles have only within this century been rescued from ruin and destruction by their transference from the architraves of the Parthenon to the British Museum. The recent discoveries therefore at Argos have occasioned the deepest interest on the continent among artists and lovers of art. They may come to light unquestionable works of Polycletus. Although inferior to Phidias "in the fashioning of gods in general," he was the most celebrated of Greek sculptors in the perfection of his colossal statues and in the superior representation of beautiful gymnastic figures. One of his statues, the Doryphorus, became a canon of the proportions of the human frame. Pliny ascribes to him the establishment of the principle that the weight of the body should be laid chiefly on one foot, whence resulted the contrast, so significant and attractive, of the bearing and more compressed with the borne and more developed side of the human body. Polycletus is recorded to have conquered Phidias, Ctesilaus, Phradmon, and Cydon with his Amazon in a contest of artists at Ephesus. We are glad to learn that the Greek Government will permit casts to be taken of these newly-discovered sculptures, which we may therefore expect will soon become as general and as valuable models as the Niobe and the Elgin Marbles. The excavations also, we understand, are to be continued. We hope that this spirit of antiquarian research in Greece, thus rewarded and excited, will induce King Otho to direct similar explorations on the sites of the Argive Temples of the Lycian Apollo, Bacchus, Minerva, and of other monuments of Argos. Their localities are minutely described by ancient and modern travellers. The majority of our readers, may not know that Pausanias commonly gives the distances and measurements of the Greek temples with minute accuracy, as tested by travellers of our own times. He moreover, records particularly all the chief works of sculpture in every building. His account, also, of pictures is equally singular and full. The description of one great work of Polygnotus—the subject of which was the taking of Troy and the embarcation of the Greeks—occupies several pages. The new Ministry at Athens will find a useful guidebook if they only first exhaust Pausanias. If Greece will not progress, His Majesty may as well increase the stores of Dresden and Munich.—*Evening Mail.*

Inaugeration of the Calcutta Railway.

This great event took place on the 3rd February 1855. The line is now completed for 122 miles to the collieries at R nee-gunge, but Burdwan, a town of importance, about 68 miles from Calcutta, was selected for the ceremonies of the day, in order to suit the convenience of all parties. Two trains were appointed to convey 600 passengers from Calcutta to that station. The terminus at Howrah opposite Calcutta was decorated for the occasion with great taste.

"The train reached Burdwan in about three hours. The whole Government (the Governor-General excepted) was on board, and a bishop and a bishop elect. It was important, therefore, that the utmost care should be exerted to prevent accidents. At Burdwan the station was decorated in the most tasteful style, and a sumptuous entertainment was spread in a noble pavillion for 700 guests.

The enthusiasm of the natives along the line was boundless. The towns and villages poured forth their inhabitants by hundreds and thousands to witness the grand spectacle, and in many places, more especially where education had made progress, gave us the most hearty cheers.

Contracts have been made for the completion of more than 600 miles from Burdwan to Cawnpore, and Mr. Stephenson is pushing forward the operations with all his characteristic energy, and is so sanguine as to expect that the works will be accomplished in three years. There can be no doubt that all the earth-work and masonry may be completed within that period; but four bridges have to be constructed as large as London-bridge, and one of them of a depth of 70 feet, and, as it appears to the engineers desirable to avoid the construction of temporary bridges, and to make those which are built permanent, there may be more delay than is at present anticipated."

Three thousand miles of Telegraph have been completed during one year in this Presidency, and it is hoped to furnish one thousand miles of Railway in three years. The value of the electric telegraph is likely to be fully shown during the approaching summer. The Governor-General Lord Dalhousie, whose health is in a declining state, will pass the hot weather and the rains at Ootacamund. The Foreign and Military Secretary will accompany him, and, thanks to Dr. O'Shaughnessy, he will be able to direct the affairs of India from his mountain eyrie with such facilities as no previous Governor-General has ever enjoyed. The electric telegraph has now been completed to the capital of each presidency, and it passes through the Ootacamund. By this matchless instrument he will be in daily and hourly communication with all the subordinate Governments, and will be able to issue his instructions to every part of the country, and before sunset to receive information of their having reached the most distant extremities of the empire. By the time he arrives at Ootacamund the telegraph

will have been completed to Peshawur, and he will be enabled, though 2,000 miles distant, to regulate the negotiations with Dost Mahomed day by day.—(*Correspondent of the Times.*)

Novel Galvanic and Electrotype Apparatus.

An important invention has recently been specified by Mr. Charles Weightman Harrison, of Richmond, Surrey, for "Improvements in obtaining and applying electric currents, and in the treatment of certain products derived in obtaining the same," parts of such improvements being applicable to the production of motivo power. The inventor employs cast amalgam plates, produced by melting zinc in a crucible, and carefully adding mercury thereto in small proportions at a time, through a small earthenware funnel, with the end of the tube inserted in the molten metal. This amalgam is, for a short time, exposed to a slow heat, and then cast into the form and size required. Plates formed of 1 part mercury and 100 parts zinc, are said, when galvanically arranged, to give a current of higher power than common amalgamated zinc plates, and to retain a protective character throughout. As negative electrodes, an alloy of iron and platinum, formed by strongly heating the metals together in a covered crucible, is used; 1 part of platinum and 100 parts of iron, give a product which is unaffected by nitric or sulphuric acids of the ordinary commercial strengths, and which may, when cast, be hammered or rolled into thin sheets, and cut into convenient sizes. There is a peculiarity in the form of the negative electrodes which gives them a large increase of effective surface over the positive electrodes, and consists of bending the plates in a zigzag manner over their whole surface, and then dividing the bends to within a short distance of one or both ends, so as to afford openings whereby the lines of electric induction may pass direct to the back of the plates, or by partly dividing plates of metal into numerous bars, or segments, by which the same increase of surface and results are obtained. A powerful galvanic current is produced by bending a negative electrode, formed as above, across the middle, so as to oppose it to both surfaces of the positive electrode, and then immersing them in a vessel containing, in addition to the usual electrolytes, an oxide of chlorine, the protoxide, or euchlorine, being preferred; such galvanic combination, from the characteristic properties afforded by the compound of oxygen and chlorine, is called by the inventor "the euchlorine battery." The presence of an euchlorine compound of oxygen in the exciting fluid, gives rise to the ready production of secondary results, and thereby affords a powerful development of electricity, equal to that of the nitric acid double fluid batteries; while it is free from the inconvenience attendant on their use, and, by proper adaptations, its operations may be maintained for a lengthened period. The peculiarities of the inventor's concentric battery are, that each of the positive plates is formed of a like quantity of metal, consequently they are progressively thicker as their size diminishes; two negative plates intervene between the positive plates, and these are separated from each other by a non-conducting material, each pair of negative plates, however, being united so as to operate as one plate. The whole of the plates are contained in a square case, and the exciting solution employed, where long-continued action and moderate power is required, is a saturated solution of muriate of ammonia, a supply of the solid salt being placed in the vacant spaces at the corners, behind perforated screens. To avoid the inconvenience which is often experienced by the use of porous earthenware cells, from their being rarely alike permeable, asbestos, or other incombustible amphibolite mineral is employed, by reducing it to a pulpy mass, and manufacturing it into sheets by the usual process of paper-making, these sheets being cut into the required sizes for diaphragms, and the edges united with gutta percha, or other material.

The second branch of the invention consists of the application of electric currents around electro-magnets through square or rectangular-formed wires or ribbons, that conductor being found to possess great superiority over common round wire. In the application of electric currents as a motive power, what is termed a "plate horse-shoe electro magnet" is used. It is manufactured of drawn plates of fibrous decarbonized soft iron, about a quarter of an inch in thickness, which are bent along the middle in the direction they have been drawn to the shape of an ordinary horse-shoe magnet, and until the arms are about a third of an inch distant from each other; the great length of poles, and the large, thin rectangular arms being the main peculiarity of the magnets. They can be applied in various ways for the production of motive power. The inventor gives descriptions of several methods of producing motion; it is not necessary here to enter into detail.

The third and last branch of the invention consists of improvements in the manufacture of colouring matter from the metallic salts derived in obtaining galvanic electricity, the improvement being that, instead of producing colouring materials from galvanic solutions, by the addition thereto of the alkaline salts of chromium and ferrocyanogen, the acid solutions of these colouring bases are employed, and the chromic and ferrocyanic acids are caused to combine with, and be taken up by, the metallic salts or oxides. The colours thus produced are adapted for use in the manner of ordinary colours, and from the fact of their being principally composed of oxide of zinc, they possess a more permanent character than common colours or paints.—*Mining Journal.*

Canadian Minerals at the Paris Exhibition.

Specimens of the following Minerals and products of Mineral origin have been sent to the Great Exhibition at Paris, as representatives of the Mineral wealth of Canada:

Iron Oxydes, from Marmora, Madoc, Sherbrooke, Crosby, Hull, Leeds, and Portage du Fort.
Bog Iron, from McNab, Wallace, Lake Nipissing, Houghton, Vaudreuil, Nicolas, Machiche, Point de Lac, St. Pierre, Cap de la Madeleine and St. Valier.
Titanic Iron, from Sutton and Brome.
Ilmenite, from Bay St. Paul and St. Urbain.
Blende, from Lake Superior.
Galena, from Lake Superior, Gaspe, Ramsay and Lansdowne.
Copper Ore, from Lake Superior, Lake Huron and Inverness.
Native Copper, from Lake Superior.
Gold and Silver Pyrites, from the Eastern Townships.
Nickel, from Lakes Huron and Superior and d'Aillebout.
Native Silver, from Lake Superior.
Native Gold, from Rivière-du-Loup, Fief Saint Charles, Aubert de l'Isle, Etchemin, Chaudière and Famine Rivers and from the neighbourhood.
Platinum, from the Fief St. Charles.
Iridium, from do.
Gold Pyrites, from Beauce.
Silver Pyrites, from do.
Arsenical Pyrites, from do.
Ochre of Uranium, from Madoc.
Chromiferous Iron, from Bolton and Ham.
Cobalt, from Lake Superior.
Manganese, from Quebec.
Iron Pyrites, from Lanoraye and the Eastern Townships.
Molybdenite, from Lake Superior and Sommerville.
Dolomite, from Dalhousie, Blythefield, Sutton, Brome, Shipton, St. Sylvestre and Pointe Levi.
Magnesia, from Sutton and Bolton.
Iron Ochre, from St. Anne, near Quebec, Cap de la Madeleine, Shipton, Pointe de Lac and Rimouski.
Barytes, from Burgess and Lansdowne.
Phosphate of Iron, from Vaudreuil.
Lithographic Stone, from Marmora.
Agates, from the North Shores of Lake Superior.
Labradorites, from Grenville.
Jasper, from Lake Huron.
Red Quartz Agate, from Lake Superior.
Perthites, from Bathurst.
Rubies, from Burgess.
Talc, from Bolton and Potton.
Mica, from Grenville.
Plumbago, from Grenville and Burgess.
White Freestone, from St. Maurice.
Amianthinite, from Dalhousie and Kamouraska.
Phosphate of Lime, from Perth.
Gypsum, from Brantford and Oneida.
Shell-Marl, from Ottawa, Sheffield, Montreal and Stanstead.
Whet-Stones, from Madoc and the Eastern Townships.
Canadian Tripolite, from Laval.
Slate, from the Eastern Townships.
White Granite, from Hereford, Barnston, St. Joseph and Nicolet.
Pseudo-Granite, from Nicolet and Lorette.
Freestone, from Ramsay, Pembroke and St. Maurice.
Calcareous Freestone, from Lauzon and Chaudiere.

Lime, from Marmora, McNab, Les Chats, Gloucester, Montreal, Packenham and Caughnawaga.
Trap, from St. Roch.
Marble, from Oxford, Brompton Lake, Dudswell, St. Armand, St. Lin, McNab and Pakenham.
Hydraulic Lime, from Thorold, Quebec, Oneida, Nepean and Brantford.
Bricks for Building, from various places.
Peat, from Longueuil and Sheffield.
Asphaltum, from Enniskillen.
Aerolite, found in Madoc, forming a mass of Iron with 6.35 per cent. of Nickel, weighing 370 lbs.

The Refuse of the Smelting Furnaces.*

The production of iron by the smelting-furnaces of Great Britain has reached 3,000,000 tons annually; and by a moderate calculation, it may be assumed that for every ton of iron two tons of slag are formed, making an aggregate of at least 6,000,000 tons of this hitherto refuse material. Not only has this vast accumulation of slag been to the present time comparatively useless, but it has proved an incumbrance and source of heavy expense to the ironmasters; for it is calculated that a sum of not less than £150,000 sterling is annually expended by and lost to them in removing the unsightly heaps from their premises, to be used as the most worthless of materials in mending old roads, and in filling gullies and other vacant spaces. We are, however, destined, before long, to witness this singular substance applied to economic purposes of the highest utility; and we venture to predict that it will be hereafter seen superseding the labours of the quarry, rivalling the most valuable marble, and even in beauty and brilliancy many of the precious stones, such as the agate, the jasper, the different classes of variegated marbles, and even the very attractive malachite.

We now proceed to notice a highly interesting paper, read at the Society of Arts, by Dr. William H. Smith, of Philadelphia, U.S., "On the Utilisation of the Slags, or Molten Mineral Products of Smelting Furnaces." The term "slag" has been defined by most standard authorities as the "refuse vitreous products of smelting furnaces," a definition which, being only applicable to slag in its altered conditions, after having been rendered brittle and worthless by improper treatment succeeding its withdrawal from the smelting furnace, he rejects as erroneous. In order to be fairly viewed and justly appreciated, slag must be considered both in its molten state, as a fused mineral product, and in the variety of combinations, forms, and general properties it may be made to assume, under scientific treatment, subsequent to its removal from the smelting furnace. The first general view which slags thus considered naturally present, is that which relates to their philosophic character, which we briefly notice before passing to consider a more important aspect—viz., their commercial value.

In the wide range of geological science we find but few general phenomena which cannot be elucidated by the chemico-mineralogical transformations of the smelting furnace. In that vast apparatus, by the study of existing operations, agencies, and laws, the geologist finds a clue to the formation of the earth, an exponent of those laws and phenomena which have modified and determined the condition of the rocky crust of the globe. When his cupola is built, and his blast started, the metallurgist is at once ready to daguereotype, or rather reproduce, although in minature, the mountainous deposits and diversified formation of the igneous rocks; and if his researches verge upon chemical science, in studying the agency of heat on the form colour, and other properties of matter, he can observe the influences which determine the crystaline or amorphous structure of slag, and those wonderful chemical affinities which bind together in definite atomic proportions the elementary molecules of slag, however complex the combinations it may assume under the smelting operation.

The rocks of igneous origin are well known to the scientific world, and highly appreciated by the practical architect; they are the rocks of which Nature builds her loftiest mountains, and man constructs his most enduring monuments. Many of the mountain ranges even of this island are composed of those strata which have been thrown up and altered in mineral aspect by molten masses and veins, presenting no traces of decomposition, and which, like slag, are of igneous origin. Granite, syenite, protogine, serpentine, poryhyry, basalt, felspar, greenstone, lava, &c., are amongst the varieties of the igneous rocks, and the industrial purposes to which they are applied are numerous, and of primary importance. If we admit the existence of some deep-seated source of heat to which these rocks owe their origin, the anagoly between them and the products of smelting furnaces, which are composed of the same elements, fused by the same igneous agency, and modified in form, colour, and character, by the same fixed chemical laws, a doubt cannot be entertained of the value of this artificial mineral product, as combining in itself qualities possessed and divided amongst many natural varieties. Selecting the slags of iron furnaces, they will be found composed of silica, lime, and alumina, as their chief ingredients, in combination with traces of magnesia, protoxide of iron, sodium, potassium, carbon, manganese, carbon, sulphur, titanium, and phosphorus. According to the analysis of M. Berthier, the slag of the Dowlais furnaces, from which some of the manufactured samples exhibited were made, consists of silica, 40·4; lime, 38·4; alumina, 11·2; magnesia, 5·2; protoxide of iron, 3·8; and a trace of sulphur. Slags from other iron furnaces in France and England presented similar analytical results, varying slightly as to the relative quantities of manganese and sulphur, while a mean average of the anthracite furnaces of America shows their slag to consist of silex 51, lime 21, and alumina 15. Prof. Philips, in his mineralogical work, observes:—"If we look more narrowly into the composition of the crust of the globe, as consisting chiefly of the earths and earthy materials, we find that only three of the earths which have been discovered—viz., silica, alumina, and lime, are found to constitute its great bulk." Regarding, therefore, silica, lime, and alumina, as the chief constituents of slag, we are furnished with the very ingredients out of which Nature has fashioned and annealed nearly all the valuable building materials of the mineral kingdom.

In the utilisation of slag for commercial purposes, by the processes of casting, pressing, rolling, moulding, and annealing, the facilities afforded by the extremely liquid molten state to which the slag is reduced in the smelting furnace are availed of, so that by suitable appliances any desired form, colour, or texture, can be imparted. We here adopt the descriptive language of Dr. Smith:—"According to the treatment it receives, slag can be rendered brittle or tough, hard or soft, compact or porous, rough or smooth. It can be cast into as great a variety of forms, solid and hollow, as iron itself, with the superior advantage of being susceptible of the admixture and blending of colours, so as to render it equal in brilliancy to agate, jasper, malachite, the variegated marbles, and other more valuable varieties of the mineral kingdom. When properly annealed, it can be made to acquire a surface, or texture, at least 10 times as durable as that of marble, and is susceptible of a polish equal to agate or cornelian. As a building material slag can be readily adapted to any variety of architectural design, from the simple slab to the most ornate and complex decoration; whilst its beauty and durability chiefly recommend it as an article of luxury."

Dr. Smith entered into a comparison of the relative expense of the manufacture of clay bricks as compared with that of bricks or blocks of slag; and he reminded us, that in making bricks of the latter, the raw material cost less than nothing, inasmuch as the ironmaster saves by its utilisation the heavy expenditure now attendant upon its removal from the furnace premises. In fusing slag for the operation of casting no expense is incurred, inasmuch as this item of expenditure is charged by the metallurgist to the metallic and *not* to the earthy products of the smelting operation; whereas, in making bricks of clay, the raw material has an intrinsic value, while the consecutive operations of digging the clay, preparing it for use, and transporting it, added to the process of pressing and annealing, consume at least twice as much time and labour as are employed in working slag. "From these simple, yet clear data," observed Dr. Smith, "we can fairly infer that the cost of making clay brick will be double that of making blocks, tiles, or more decorative and valuable articles from slag. By extending this calculation to other products, such as marble slabs, columns, carved architectural ornaments of stone, &c., and in our estimate contrasting the plastic power of fusion available in slag with the laborious hewing and fashioning by mechanical means required for blocks of marble and other stones, we may arrive at still more satisfactory results in proving the commercial value of slag."

The samples which were exhibited and examined by the auditory excited general admiration, from the closeness of the texture, the height of the polish and the beauty and apparent durability of the articles. Some of them had been made from the slags of American furnaces, others from those of the furnaces of France and England: and it was evident, from their inspection, that the commercial value expressed in the above calculation was by no means extravagant. To

* *The Mining Journal.*

the vast quantity of iron slag produced in England may be added the amount also yielded in the reduction of ores of copper and lead, without considering zinc and other metalliferous sources; the supply will, accordingly, be found sufficient to create a new channel of productive industry, which may possibly equal in extent, interest, and importance, any single one that now affords employment to the capital and industry of civilised nations.

CANADIAN INSTITUTE—SESSION 1854-55.

Fifteenth Ordinary Meeting—March 31st, 1855.

The name of the following candidate for membership was read:—

Mr. Sheriff Jarvis.................................. Toronto.

The following gentlemen were elected members:—

John Macpherson Hamilton .... Toronto.
William Dickson.. "
H. T. Bown.. Hamilton.
Robt. J. Johnston .... Thorold.
W. H. Lambe .... Montreal.
Frederick W. Torrance.............................. "
Hon. John Young...................................... "

Mr. Cumberland read a paper, entitled "Some Notes of a Visit to the Works of the Grand Trunk Railway of Canada, West of Toronto."

A Paper, communicated by Mr. Paul Kane, was read by Mr. G. W. Allan, "On the Habits and Customs of the Chinouk Indians."

Various articles of dress worn by the Chinouk Indians, specimens of their bows and arrows, spears, cooking utensils, and a skull taken from one of their graves, were exhibited. Several admirable oil paintings, executed by Mr. Kane, illustrated many important features of the lives and characters of the Chinouk Indians.

Sixteenth Ordinary Meeting.—April 14th. 1855.

The names of the following candidates for membership were read:

Rev. W. Ritchie .... Georgina.
George Perkins .... Toronto.
Stephen Heward.. "

The following gentleman was elected member:—

W. B. Jarvis.. Toronto.

In pursuance of an order from the Council, the First Vice-President brought under the consideration of the meeting the subject of a new building for the purposes of the Institute, invited discussion thereon, and announced that a special general meeting would be called for Saturday, the 21st instant, for the purpose of considering the propriety of issuing authority to the Council to act in the matter.

The First Vice-President nominated Mr. Dalrymple Crawford, Auditor of Accounts for 1855, in conformity with the regulations of the Institute. Mr. Samuel Spreull was nominated on the part of the meeting.

Professor Chapman communicated an "Additional Note on the Object of the Salt Condition of the Sea," and submitted further views and authorities in support of his observations on an example of the igneous origin of Carbonate of Lime.

Professor Cherriman read a communication from Mr. A. Hood, of Dunnville, being "A Description of a new Astronomical and Surveying Instrument."

Special General Meeting.

April 21st, 1855.

The name of the following candidate for membership was read:—

George Morphy.. Toronto.

The following gentlemen were elected members:—

Stephen Heward .... Toronto.
Rev. W. Ritchie.. Georgina.
George Perkins.. Toronto.

The following donations from the Hon. J. M. Brodhead, of Washington, through Mr. A. H. Armour, were announced:—

Espy's Report on Meteorology.
United States' Coast Survey, with Maps, 1853.
Stanbury's Expedition to the Great Salt Lake, with Maps.
Patent Office Report, Part 2, 1853.
Official Army Register, United States, for 1855.
Navy Register of the United States, 1855.
From Mr. A. H. Armour, Toronto:—
Census of Canada, 1851-52, in two volumes.

The thanks of the Institute were ordered to be given to the Hon. J. M. Brodhead and Mr. Armour for their valuable donations.

Mr. Sandford Fleming, C.E., read a paper by Mr. T. C. Clarke, C.E., "On the Action of the Ice upon the Bridge at Rice Lake."

Professor Hind made some observations "On the occurrence of Crystallized Carbonate of Lime in the Native Copper of Lake Superior."

The meeting then entered upon the subject of the new building, and after a prolonged discussion, the following resolutions were adopted:

Moved by Mr. Ure, seconded by Mr. Recorder Duggan:—

1. "That it is the opinion of this meeting that the ground which has been so handsomely offered by Mr. Allan, for a permanent building for the Canadian Institute should be at once accepted, and that the cordial acknowledgments of the Institute be tendered to the generous donor for his munificent gift"

Carried, *nem con.*

Moved by Mr. Recorder Duggan, seconded by Mr. W. G. Storm,

2. "That in the event of its being found possible to erect a building for the purposes of the Institute, the Council be authorized to take such steps as shall seem most advisable both for that purpose, and also for securing such temporary accommodation as will be required."

Moved by Mr. Walter Mackenzie, seconded by Mr. Secker Brough,

3. "That the thanks of the Institute be tendered to Mr. Cumberland for his generous offer to give his services as Architect of the building proposed to be erected."

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY OR STATED MEETING.

Wednesday, 7th March, 1855.

The following gentlemen were proposed as Associate and Corresponding members, viz.:—

As Associate Member..................Geo. Desbarats.
As Corresponding Member...........T. E. Campbell, C.B., late Major 7th Hussars.

A paper "On Russian America" was read by Mr. A. R. Roche.

STATED MEETING.

21st March, 1855.

The following donations were announced from T. D. Harington :—

Guizot's Life of Cromwell.

Mackintosh's Military Tour through the Seat of War, Crimea, &c.

Slavery on African Coast.

Huc's Travels in Tartary, Thibet, &c.

Scientific Annual, 1852 and 1853 (United States).

Year Book of Facts, 1852 and 1853.

From G. B. Faribault:

Public Accounts of the Province of Canada for 1853.

Annual Report of the Postmaster General, for the year ended 31st March, 1854.

Return from the Clerk of the Crown in Chancery, showing the number of Votes polled in each County.

Documents submitted by the Bureau of Agriculture to the Legislature.

Report of the Superintendent of Education, Lower Canada, for 1853.

The Seigniorial Tenure of Canada, and Plan of Commutation, by J. C. Taché.

Tables of the Trade and Navigation of the Province of Canada, for 1853.

Census of Canada for 1851 and 1852, vol. 2.

The thanks of the Society were ordered to be given to T. D. Harington and G. B. Faribault.

The following gentlemen were proposed as Associate Members.

Walter Serocold, late Captain, 66th Regiment.

William Chessell.

A Paper was read by F. N. Boxer, submitting certain suggestions for the better conducting the affairs of the Society.

Resolved that F. N. Boxer's paper be referred for the consideration of the Council of the Society.

A Paper was read by A. R. Roche, entitled, "A Proposal for extending the Trade of the Province."

HENRY E. STEELE,
Recording Secretary.

Chair of Natural History, Edinburgh University.

Some difficulty appears to be found in selecting a fitting successor to Professor Edward Forbes; and we have referred, on another page, to a discussion this has given rise to. According to the latest accounts, we learn that the idea is gaining ground of subdividing the Chair into two Professorships. One of Geology, for which it is understood the Duke of Argyle—who takes a lively interest in the question—destines Hugh Miller; the other of Natural History, in its several distinct branches, exclusive of Botany, which already constitutes a separate Chair. For this Mr. Allman, of Trinity College, Dublin, is favourably spoken. Though there are various other candidates—Mr. Huxley, of the London Museum of Practical Sciences, and recently one of the candidates for the new Chair in University College, Toronto; Professor Nichol, formerly of Cork, and now of Aberdeen; and Dr. Fleming, of New College, Edinburgh. The revenues of the Chair are estimated at upwards of £1000 stg.; so that it is a rare prize in the scientific lottery, and may be expected to excite abundant emulation. The great difficulty in finding a fit successor to Edward Forbes is no slight testimony to the profound and singularly varied range of acquirements of the late Professor of Natural History at Edinburgh.

The Hurricane of the 18th April, 1855.

The progress of the remarkable storm which swept over a large portion of Western Canada during the 18th of last month, has been recorded by the local Press of many localities where its destructive effects were visible, or the various phenomena which accompanied it particularly manifest. We propose to condense the various accounts which have reached us, and present them in a connected form in the June number of this *Journal*. We shall feel indebted to our readers and correspondents for any exact information or description they may have it in their power to communicate.

Miscellaneous Intelligence.

Elevation of the Land in Human Period.—General De la Marmora, who has been employed twenty-four years on a geographical and geological survey of Sardinia, presented an outline of his researches in the latter department to the Geological Society of France on 6th November last. In this paper he states that near Cagliari he found a raised beach containing shells mixed with works of human art (pottery), at an elevation of 197 feet (60 metres) above the sea. It seems to be slightly *inclined;* and he speaks of another deposit, probably a newer one, a little farther on, which is horizontal and almost at the level of the sea. He estimates that at Alghero, 100 miles NNW., the rise produced by the same upheaval has been 328 feet, not attested, however, by human remains, but by the position of a "quaternary sandstone." The extreme rarity of raised beaches containing such remains renders these facts interesting. Mr. Lyell refers only to three—one which I have seen, at Putzuoli, 20 feet above the present sea level; another near Stockholm, 60 feet above it, and a third in Peru, seen by Mr. Darwin, 85 feet. It now appears that some parts of Sardinia have been upheaved 197 feet since the island was occupied by man.

Velocity of the Electric Current.—At the meeting of the Belgian Royal Academy on 2nd December, M. Quetelet described Mr. Airey's experiments with the electric telegraph to determine the difference of longitude between Greenwich and Brussels. The time spent by the electric current in passing from the one observatory to the other was found to be 0s.109, or rather less than the *ninth part of a second* and this determination rests on 2,616 observations. The distance between the towns being 270 miles, the velocity of the current, supposing it to be uniform, must rather exceed 2,500 miles per second, or about one-seventh greater than that obtained by the American observers, a speed which would "girdle the globe" in ten seconds. The difference of longitude from two series of observations, and by two methods, was found to be 17m. 28s.9. Observations made by an eclipse of the sun in May 1836, gave precisely the same results which may be considered the most correct; an eclipse of the sun in 1842, gave four-tenths of a second less; lunar occultations gave nine-tenths of a second less; and observations by chronometers gave 1 second and three-tenths less. A second in this case represents a distance of 455 yards, and a tenth of a second 45½ yards. Assuming the first-mentioned time to be correct, the error in the chronometrical determination is equivalent to 591 yards, or the ninth part of a mile, which, after all, is only the 2430th part of the whole distance.

Egg of the Epyornis.—At the meeting of the Academy of Sciences on 5th March, M. I. G. Saint Hilaire presented two eggs of this gigantic bird. The volume of one of them exceeded nine cubic decimetres, and must therefore have been equal to a sphere 10.4 inches in diameter, or to an egg-shaped body (an oblong spheroid) measuring 9 inches by 12. In a later number of the journal from which this notice is taken, we find the dimensions of three eggs of the Epyornis, of which the largest is as follows:—Longest axis 12.15 inches, shortest axis 9.37 inches; elliptical circumference 36.4 inches. The Epyornis is an extinct Madagascar bird, supposed to have been nearly *fourteen feet* in height.

New Gigantic Fossil Bird.—Professor Constant Prevost submitted to the Academy of Sciences on 12th March, the fossil bone of a bird found in the Paris basin, near Meudon. It was a *tibia* or leg bone; its length 17¾ inches its breadth at the lower end fully 3 inches; at the upper 3¾; at the middle 1¾. A difference of opinion existed among the naturalists as to whether it belonged to an Echassier (a long-legged bird) or a Palmipede. If the former, M. Prevost thought that it must have had twenty times the bulk of the swan. M. Valenciennes regarded it as more allied in form to the albatross, and in this case its dimensions will not be so great as M. Prevost conjectured. It has been named Palæornis Parisiensis, and was found at the bottom of the tertiary beds, resting on the chalk. It was therefore much older than the huge birds of New Zealand and Madagascar, which are found in alluvial deposits.—C. M., *Scotsman.*

Meteorological Observations, Fort Brady, Michigan. February, 1855.

Latitude, 46°·39 North; Longitude, 84°·43 West. *Altitude of Barometer above the Ste. Marie River 22 feet.*

Compiled for the Canadian Journal, by John T. Newton, *Acting Assistant Surgeon, U.S.A.*

Feb.	Barometer.				Therm'ter Attached.				Thermometer Detached.					Clearness of Sky.				Wind.				Rain.			
1855	S'nrise	9 A.M.	3 P.M.	9 P.M.	Sun-rise.	9 A.M.	3 P.M.	9 P.M.	Sun-rise.	9 A.M.	3 P.M.	9 P.M.	D'ly M'n.	Sun-rise.	9 A.M.	3 P.M.	9 P.M.	S'nrise	9 A.M.	3 P.M.	9 P.M.				
1	29·252	29·268	29·122	28·910	16	18	21	15	4	7	11	8	7·5	0	0	5	5	N E 3	N 3	S 5	S 3				
2	28·862	28·858	28·588	28·862	8	18	14	11	-9	19	25	1	8·	7	9	7	5	N E 0	E 0	W 2	S W 5				
3	28·847	28·906	28·957	28·963	3	-1	10	-5	-13	3	2	-14	-5·5	7	5	4	2	S W 0	N E 3	N E 3	N E 2				
4	29·063	29·055	29·004	29·012	-11	-10	-2	-7	-20	-12	5	-26	-7·5	2	2	6	10	N E 0	N E 0	N E 2	N 0				There is no weather so cold as this on the records retained in the Hospital.
5	28·969	28·969	29·079	29·236	-15	-13	-5	-12	-31	-7	-11	-28	-21·	0	9	5	10	E 0	E 3	S E 3	N 2				
6	29·260	29·217	29·236	29·323	-19	-15	-1	-6	-32	-19	-5	-19	-18·5	8	7	4	8	E 2	E 0	E 2	E 2				
7	29·292	29·134	29·138	29·138	-6	0	10	-3	-12	3	7	-16	-2·5	6	3	6	10	E 0	E 0	E 2	E 0				
8	29·150	29·130	29·172	29·172	-5	0	15	14	-17	-2	7	7	-5·	3	5	2	3	E 1	E 2	E 2	E 2				
9	29·236	29·244	29·260	29·291	3	13	17	22	-8	15	17	16	4·5	3	1	0	0	S 0	S 2	S 2	S 3				
10	29·252	29·252	29·244	29·165	28	30	31	21	14	22	20	10	17·	0	0	5	8	S 2	S 2	S 2	W 5				
11	29.181	29·276	29·276	29·292	6	22	28	9	-1	23	25	-6	12·	10	10	10	10	N 2	N 2	N2	N 2				
12	29·292	29·292	29·295	29·189	12	20	20	24	5	8	20	20	12·5	0	0	0	0	S 2	S 4	S5	W 5	10 A.	M.		
13	29·088	29·091	29·055	29·004	27	29	35	30	26	27	23	27	29·5	0	0	0	0	E 2	S E 2	S E2	S E 2				
14	29·134	29·138	29·138	29·256	29	30	37	24	25	23	25	11	25·	0	0	1	1	S 2	N E 2	N E2	N 4				The Thermometer detached shows a mean of -3°·3 below zero. The register of no other winter comes near equalling it in continued severity. While our Thermometer stood at -32° the Thermometers in the village stood at -36° and at the head of the 'Portage, half a mile distant, -39° below zero. The wind, though marked strong the latter part of the month, falls far short of giving the real strength of the gale when outside of the pickets.
15	29·272	29·328	29·347	29·295	20	24	33	22	13	19	31	15	22·	0	0	0	2	N 2	N 3	N 3	N 2				
16	29·228	29·229	29·213	29·217	24	23	28	24	16	18	23	16	19·5	2	2	0	0	N 2	W 2	N W 3	N 3				
17	29·240	29·284	29·366	29·366	19	22	28	27	11	21	21	20	16·	7	7	4	0	N W 2	W 0	W 2	W 0	In the night		0·65	
18	29·433	29·441	29·429	29·449	21	23	26	22	13	21	25	12	19·	1	6	6	10	W 0	N 1	N 3	N 0				
19	29·433	29·465	29·449	29·465	10	14	35	30	-3	34	53	15	25·	10	10	10	10	W 0	W 2	N W 2	N W 2				
20	29·583	29·587	29·587	29·581	16	16	25	17	4	13	39	4	21·5	5	2	5	10	N 0	N 0	N 2	N 0				
21	29·575	29·575	29·579	29·402	15	29	33	27	5	39	41	12	23·	2	3	5	0	S 0	S 0	S 3	W 7				
22	29·394	29·449	29·449	29·551	12	16	15	10	-5	16	5	-5	0·	7	6	4	7	N W 2	N W 5	N W 6	N W 5				
23	29·469	29·461	29·551	29·500	-4	-2	-2	-1	-15	1	-2	-5	-8·5	8	5	6	7	N 0	N 1	N 3	W 5				
24	29·425	29·449	29·449	29·449	-9	2	2	2	-21	8	1	-6	10·	10	7	7	7	S E 0	W 6	W 7	W 5				
25	29 276	29·256	29·205	29·189	-2	2	5	6	-10	2	3	-1	-3·5	7	6	5	6	W 6	W 7	W 7	W 6				
26	29·193	29·205	29·114	29·193	5	10	17	14	3	10	23	-1	12·5	0	5	7	9	W 6	W 5	W 4	W 0				
27	29·284	29·315	29·445	29·457	6	15	18	15	-7	19	5	-3	-2·5	6	6	7	10	S 0	S 1	S W 4	S W 5				
28	29·575	29·638	29·630	29·634	2	5	22	19	-12	16	35	0	11·5	10	10	10	10	S 0	S 0	S 1	S 1				
	29·272	29·268	29·287	29·237	8.15	14·10	18·25	13·9	-3·3	16·2	17·8	2·8	3.21	4·9	5·7	4.23	5·8							0·65	

The above will show February to be an extremely cold month, far exceeding any month since 1844, (the period which our Registers date back to), in continued severity, as the following synoptic analysis will show:—

The grand mean temperature of the month of February, 1844, was 21°·20 above zero. The *minimum* mean was 14°·65, and the *maximum* mean was 27°·62 above. The lowest observation registered was -20°· (below zero). The month was comparatively calm. No Auroras or Halos. The amount of snow in a fluid state was 0·43 hundredths of an inch. Navigation opened this year on the 22nd of April.

The grand mean of February, 1845, was 20°·3 above zero. The *minimum* mean was 14°·7, and the *maximum* mean was 23°·9 above. The lowest observation registered was -16°· below zero. The wind moderately strong. Two Auroras were observed. The quantity of snow 1·88. Navigation opened this year on the 25th of April.

The grand mean temperature of February, 1846, was 17°·8 above zero. The *minimum* mean was 11°·2, and the *maximum* mean 24°·5. The lowest observation registered was -22°· (below zero.) This month was extremely calm. Two dim Auroras were observed. The quantity of snow 9·35. The nine thirty-five is evidently an error in the Register. Navigation opened on the 23rd of April.

The grand mean temperature of February, 1847, was 15°· above zero. The *minimum* mean was 6°·5, and the *maximum* mean 24°· above zero. The lowest observation was -16°· (below zero). One bright Aurora. The quantity of snow was 0°·80. Navigation opened on the 9th of May.

The grand mean temperature of 1848 was 21°·20. The *minimum* mean was 15°·4, and the *maximum* mean 29°·5. The lowest observation registered was -5°· (below zero.) The month was extremely calm. One beautiful Aurora. The quantity of snow 1·83. Navigation opened on the 26th of April.

There was no Register kept during the winter of 1849. The grand mean temperature of the month of February, 1850, was 22°·27. The *minimum* mean was 13°·26. and the *maximum* mean was 31°·26 above zero. The lowest observation was -11°· (below zero). Wind at times very strong. The quantity of snow 1·83. Navigation opened on the 3rd of May.

The grand mean temperature of February, 1851, was 21°·19. The *minimum* mean was 14°·26, and the *maximum* mean 31°·13 above zero. The lowest observation -10°· (below zero). Navigation opened on the 2nd of May.

The grand mean temperature of February, 1852, was 16°·17 above zero. The *minimum* mean was 12°·23, and the *maximum* 22°·22 above zero. The lowest observation -26°· (below zero). The quantity of snow was 2·00 (two inches). Navigation opened on the 7th of May.

The grand mean temperature of February, 1853, was -28°·12 above zero. The *minimum* mean was 8°·27, and the *maximum* mean 24°·4. One Lunar Halo observed. The quantity of snow was 1·19. Navigation opened on the 28th of April.

The grand mean temperature of February, 1854, was 11°·3 above zero. The *minimum* mean was 4°·23, and the *maximum* mean 17°·14 above zero. Two Auroras were observed, and a luminous meteor on the night of the 28th was observed to pass from the zenith to the Northern Horizon. Navigation opened on the 7th of May.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—March, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
1	30·060	29·966	29·952	30·001	—2°·9	31°·5	24°·1	19°·2	— 6°·0	0·039	0·120	0·115	0·097	·93	·68	·86	·82	N W b W	S W	W S W	7·74	...	...
2	29.900	·788	·733	29·798	23·7	35·2	30·2	29·6	+ 4·2	·119	·184	·150	·151	92	90	89	90	S W b W	S W b S	Calm	5·46	...	1·0
3	·653	·564	·659	·625	29·4	34·7	34·8	33·3	+ 7·6	·148	·165	·183	·170	91	86	92	90	S W b W	S W b W	W b S	4·98	...	...
4	·740	·706	—	—	26·6	39·5	—	—	—	·127	·176	—	—	87	73	—	—	N W b W	S	S W	7·00	0·170	...
5	·335	·187	·031	·182	36·5	39·7	39·5	37·7	+11·4	·205	·214	·184	·192	95	88	76	85	S W b W	S W b S	W b S	15·41	0·005	...
6	·391	·464	·564	·482	26·6	33·9	20·6	26·5	0·0	·126	·160	·102	·126	86	81	90	85	W N W	W N W	N	8·97	...	...
7	·524	·484	·717	·584	17·6	27·3	23·7	23·3	— 3·5	·076	·128	·119	·111	75	85	92	85	N	E b N	N N E	2·10	...	2·0
8	·790	·720	·309	·591	9·0	31·9	29·1	24·4	— 2·8	·058	·133	·148	·117	83	74	92	86	N	S b E	E S E	2·42	...	1·2
9	·238	·438	·771	·501	26·6	29·0	17·2	24·4	— 3·1	·136	·111	·085	·116	92	68	85	84	W b S	N W b W	N N W	20·72	...	0·1
10	·994	·903	·776	·880	7·9	25·5	24·8	19·4	— 8·4	·054	·102	·119	·092	81	73	87	80	N N W	S W b S	S S E	3·75	...	...
11	·586	·490	—	—	28·4	29·8	—	—	—	·146	·134	—	—	94	81	—	—	E	E N E	N E b N	7·27	...	...
12	·658	·712	·766	·726	24·8	35·1	25·5	27·9	— 0·6	·119	·128	·126	·120	87	63	89	79	N	E b S	E N E	7·58	...	...
13	·602	·304	·174	·352	25·1	27·8	30·2	28·2	— 0·8	·100	·141	·163	·139	72	91	97	88	E N E	E	E b S	20·74	...	6·0
14	·260	·369	·395	·344	33·0	38·8	36·3	36·6	+ 7·3	·169	162	·183	·179	.90	69	86	83	Calm	S S E	Calm	3·47	0·680	...
15	·137	·153	·578	·310	36·3	41·4	32·4	36·1	+ 6·4	·213	·179	·167	·181	100	69	92	86	E	W b N	W	10·92	0·415	...
16	·716	·744	·736	·730	22·7	37·8	30·5	31·1	+ 1·1	·106	·142	·148	·135	84	63	88	78	Calm	S b W	Calm	2·18	...	0·1
17	·473	·126	·403	·323	32·7	38·4	34·8	35·4	+ 4·9	·139	·167	·151	·159	86	72	74	79	E	S b W	S W b W	17·70	0·215	...
18	·625	·644	—	—	31·7	39·9	—	—	—	·149	·160	—	—	83	66	—	—	W b S	W b S	Calm	6·83	...	...
19	·653	·507	·408	·506	21·9	40·2	24·9	28·8	— 2·5	·102	·159	·113	·129	84	64	82	77	Calm	S E b S	W S W	9·72	...	0·5
20	·453	·553	·788	·613	21·0	28·0	21·9	23·7	— 7·9	·101	·095	·097	·098	89	62	80	76	W S W	W b S	W	18·35	...	Inap.
21	·933	·940	·916	·934	21·2	28·2	26·9	24·0	— 8·0	·100	·131	·131	·114	85	84	88	86	N W	W	W N W	5·25	...	...
22	·846	·679	·508	·652	17·4	32·7	23·7	25·4	— 7·1	·079	·094	·099	·097	79	51	75	69	W N W	W S W	S W b W	10·99	...	0·1
23	·143	28·858	28·960	28·981	26·9	34·0	29·8	29·6	— 3·2	·131	·161	·102	·133	88	81	61	79	S W b W	S W	W N W	16·31	...	0·3
24	·158	29·248	29·351	29·266	7·9	23·8	21·5	17·1	—16·0	·051	·078	·101	·076	76	61	84	74	N N W	N W b W	W	18·46	...	...
25	·367	·313	—	—	23·3	33·2	—	—	—	·111	·165	—	—	86	87	—	—	W b S	W b S	W	12·72	...	0·3
26	·262	·044	·082	·113	27·3	30·0	26·2	27·8	— 6·2	·133	·140	·131	·134	88	83	91	87	Calm	E b S	W b S	10·88	...	6·5
27	·260	·426	·554	·429	22·6	28·2	20·2	23·1	—11·3	·114	·124	·096	·109	91	79	86	85	N b W	N W b N	N W b W	12·52	...	...
28	·575	·545	·546	·559	20·0	29·5	23·3	24·8	— 9·9	·092	·106	·112	·102	82	64	86	75	N W b W	W b N	W b S	14·82	...	...
29	·519	·492	·537	·521	22·3	43·2	33·0	33·5	— 1·6	·100	·130	·148	·131	80	47	78	69	W b S	W S W	S W	10·55	...	...
30	·560	·546	·521	·540	29·8	46·5	34·8	37·6	+ 2·1	·136	·168	·153	·160	82	54	74	72	W S W	S W b S	Calm	5·90	...	...
31	·511	·345	·118	·308	35·0	48·6	36·6	39·8	+ 3·9	·188	·229	·184	·194	93	68	85	81	Calm	S b W	Calm	6·74	...	...
M	29·540	29·485	29·513	29·513	23·1	34·1	28·0	28·5	— 1·9	0·116	0·143	0·134	0·132	·86	·72	·85	·81	8·71	11·25	9·49	9·95	1·485	18·1

Highest Barometer...... 30·079, at 11 a.m. on 21st } Monthly range:
Lowest Barometer....... 28·792, at 8 p.m. on 23rd } 1·287 inches.
Highest registered temperature +49°·4, at p.m., 31st } Monthly range:
Lowest registered temperaturo —2°·9, at a.m. on 1st } 52°·3.
Mean Maximum Thermometer.............. 36°·52 } Mean daily range:
Mean Minimum Thermometer.............. 19°·63 } 16°·89.
Greatest daily range.........37°·3, from a.m. to p.m. of 1st.
Least daily range .... 7°·8, from p.m. of 14th, to a.m. of 15th.
Warmest day....... 31st. Mean temperature......39°·82 } Difference,
Coldest day......... 24th. Mean temperature......17°·15 } 22°·67.
Greatest intensity of Solar Radiation, 58°·2 on p.m. of 30th } Range,
Lowest point of Terrestrial Radiation, 2°·8 on a.m. of 10th } 55°·4.
Aurora observed on 5 nights: viz. 6th, 9th, 12th, 15th and 18th.
Possible to see Aurora on 16 nights. Impossible on 15 nights.
Raining on 5 days. Raining 20·0 hours; depth, 1·485 inches.
Snowing on 11 days. Snowing 44·2 hours; depth 18·1 inches.
Mean of Cloudiness, 0·67. No thunder or lightning observed during the month.

Halos were observed on the 1st, 2nd, 10th, 16th, 22nd, 26th, 28th and 30th.

Parhelia were noted on tho 16th at 7 a.m., and on the 30th at 6 p.m.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North—1644·90 West—4790·04 South.—509·00 East—1255·00.
Mean direction of the Wind, W 16° N.
Mean velocity of the Wind, 9·95 miles per hour.
Maximum velocity, 36·0 miles perhour, from 10 to 11 a.m. on 20th.
Most windy day, the 13th; mean velocity, 20·74 miles per hour.
Least windy day, the 7th; mean velocity, 2·10 " "
Most windy hour, 5 p.m.; Mean velocity, 12·48 miles per hour.
Least windy hour, 2 a.m.; Mean velocity, 8·08 miles per hour.
Mean diurnal variation, 4·40 miles.

March, 1855, was remarkable as the most windy month recorded during the last eight years, the mean hourly velocity exceeding the average by 2·94 miles, and surpassing the next most windy month, (Dec., 1854), by 1·31 miles per hour.

The quantity of snow which fell was considerable, exceeding the average of the last thirteen years by 8·2 inches, being only surpassed on two occasions—in March 1843 and 1852.

It was also a cold month, the mean temperature falling 1°9. below the average of the last sixteen years.

The Barometric pressure (29·5129) is the lowest monthly mean for any March during the whole series.

Comparative Table for March.

YEAR.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind Mean Velocity.	
1840	33·1	+2·9	56·9	8·7	48·2	8	1·640	8	...	...	
1841	27·7	—2·7	53·5	—6·9	60·4	5	1·170	7	...	0·51	lb.
1842	35·8	+5·4	68·7	14·9	53·8	4	3·150	8	...	0·70	lb.
1843	21·3	—9·1	38·6	—2·8	41·4	2	0·625	18	25·7	1·18	lb.
1844	31·3	+0·9	50·3	9·6	40·7	8	2·470	8	14·0	0·57	lb.
1845	35·4	+5·0	61·7	9·9	51·8	5	Impf.	8	2·8	0·66	lb.
1846	33·1	+2·7	49·3	7·6	41·7	9	1·965	5	2·3	0·30	lb.
1847	26·2	—4·2	44·3	4·8	39·5	5	0·850	6	4·2	0·71	lb.
1848	28·6	—1·8	58·9	0·9	58·0	5	1·220	6	9·7	5·80	Miles.
1849	33·5	+3·1	53·4	15·4	38·0	7	1·525	2	2·3	5·37	Miles.
1850	29·8	—0·6	46·0	6·0	40·0	2	0·745	7	11·2	7·62	Miles.
1851	32·4	+2·0	58·7	13·1	45·6	3	0·770	9	8·8	7·65	Miles.
1852	27·7	—2·7	44·8	—3·2	48·0	8	3·080	12	19·5	5·81	Miles.
1853	30·6	+0·2	56·3	—0·1	56·4	6	1·080	8	7·1	5·87	Miles.
1854	30·7	+0·3	52·8	10·4	42·4	9	2·425	3	2·8	8·02	Miles.
1855	28·5	—1·9	48·6	—2·9	51·5	5	1·485	11	18·1	9·95	Miles.
										0·66	lbs.
M'n.	30.37		52·67	5·34	47·34	5·7	1·613	7·9	9·9	7·01	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—March, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	10 P.M.	2 P.M.
1	30·187	30·100	30·102	0·0	[illegible]	18·3	·040	·163	·106	·88	·94	·87	S W b W	S W b W	S W	0·55	5·55	7·56	...	...	Clear.	Cir.Cum.Str.8	Cir. Cum. 4.
2	·060	29·999	29·900	9·6	37·0	29·8	079	221	168	88	92	90	S W	W S W	W b S	0·47	5·73	5·25	...	...	Do.	Clear.	Str. 10.
3	29·890	·714	·700	27·5	33·1	31·0	146	199	178	88	96	92	S W b S	S W b S	W b S	3·27	2·00	3·75	...	Inap.	Cum. Str. 10.	Slight snow.	Cir. Str. 10.
4	·935	30·004	·890	20·1	28·3	17·9	107	153	106	82	88	87	N W	W b N	S S E	11·14	4·33	0·76	...	...	Do. 4.	Cum. Str. 4.	Cir. 2.
5	·540	29·440	·269	37·0	48·7	39·0	167	312	214	70	86	84	S W	W b S	S S W	3·37	11·25	5·66	...	...	Do. 9.	Do. 2.	Rain at 9p. m.
6	·210	·514	·719	34·5	38·0	14·4	191	226	095	84	91	87	W	W	W N W	12·81	8·38	2·56	0·531	Inap.	Str. 10.	Snow at 9 a.m.	Clear.
7	·771	·814	·845	3·2	31·4	15·7	053	191	091	94	94	87	N N W	N E	N E	0·15	Calm	Calm	...	...	Clear.	Clear.	Do.
8	·999	·990	·790	5·0	37·1	16·0	053	191	076	85	80	68	N E	E b S	S b W	0·26	1.45	Calm	...	...	Do.	Do.	Cl'rAuro.Bor.
9	·500	·490	·652	12·0	28·8	22·2	085	161	123	89	88	88	N E b E	E b N	W N W	1·75	3·62	1·75	...	...	Str. 10.	Str. 10.	Do. do. do.
10	30·020	·980	·880	0·5	20·9	10·9	047	111	077	95	83	84	W N W	W b S	W b S	13·75	1·82	1·06	...	...	Clear.	Clear.	Clear
11	29·934	·829	·830	8·7	23·0	19·8	066	082	083	90	57	63	N N W	N E b E	N E b N	Calm	2·50	0·51	...	...	Cum. Str. 8.	Cum. Str. 8.	Str. 10.
12	·750	·985	30·080	21·1	39·9	21·5	111	198	123	83	75	88	N E	S W	N W	0·09	1·42	2·25	...	...	Str. 8.	Clear.	Cl'rAuro.Bor.
13	30·150	·920	29·850	11·1	21·0	19·6	082	092	097	87	68	77	N b E	N E b E	N E b E	5·50	0·75	16·25	...	...	Clear.	Cum. Str. 4.	Snow.
14	29·741	·700	·871	12·6	19·9	17·0	080	094	096	83	72	83	N E b E	N E b E	N E b E	5·40	29·93	14·33	...	5·80	Snow.	Snow.	Do.
15	·751	·541	·482	22·2	31·6	35·5	102	160	192	72	80	83	N E b E	S E b E	W b S	11·61	8·22	15·41	...	3·70	Str. 10.	Do.	Rain at 10p.m.
16	·821	·898	·989	30·1	37·4	30·6	171	218	158	91	92	81	W b S	W b S	N W b W	34·00	11·25	7·90	Inap.	...	Cum. Str. 5.	Cum. Str. 4.	Str. 10.
17	·976	·789	·545	15·7	26·9	32·0	087	119	190	78	71	96	N N W	N E b E	S	1·14	0·27	6·56	...	1·30	Clear.	Cir. Str. 10.	Cum. 10.
18	·680	·501	·890	30·6	35·0	26·6	178	203	146	92	91	88	W b S	W b S	W b S	18·30	11·81	9·12	...	...	Cir. Cum. 4.	Cir. Cum. Str.10.	Cl'rAuro.Bor.
19	·894	·876	·869	14·0	41·2	21·1	089	233	098	84	83	73	S W b W	S W b W	E b S	1·37	Calm	1·65	...	...	Clear.	Clear.	Do. Do. do.
20	·700	·742	·769	22·0	33·6	16·7	115	186	102	82	86	88	W. S. W.	W S W	W S W	4·98	8·90	6·29	...	2·10	Do.	Snow.	Clear.
21	·930	30·049	·971	11·0	28·1	10·8	077	126	067	83	73	75	W	W S W	N W b W	13·87	13·01	6·22	...	...	Do.	Clear.	Str. 8.
22	30·090	29·879	·740	14·2	32·6	18·8	084	161	080	83	78	70	W b S	S W b W	S W b W	2·92	2·52	7·12	...	...	Str. 4.	Cir. Cum. 4.	Clear.
23	29·451	·214	·045	16·3	29·0	27·9	098	150	144	88	84	86	S S W	S S W	S	1.54	4·27	8·75	...	2·70	Do. 10.	Snow.	Snow.
24	·100	·246	·340	9·4	16·1	15·9	074	081	072	82	70	73	W	W	W	14.00	16·35	12·25	...	...	Clear.	Clear	Cum. Str. 5.
25	·401	·381	·382	8·9	29·0	22·4	079	116	115	88	64	82	W	S W b W	S W	18·74	11·21	7·03	...	...	Str. 2.	Cum. Str. 9.	Cum. 2.
26	·437	·543	·436	17·1	36·7	18·6	102	161	088	88	69	72	W	S W	E b N	9·62	6·87	0·40	...	...	Light Cir.	Clear.	Str. 10.
27	·399	·481	·549	19·0	30·0	15·8	096	168	081	78	70	73	N N W	W b N	W b N	11·24	8·02	14·80	...	...	Clear.	Do.	Cir. Cum. 8.
28	·590	·560	·489	16·1	23·9	20·6	080	124	086	73	70	66	W b N	W b N	W b N	15·94	12·55	10·64	...	...	Cir. Str. 10.	Cum. Str. 10.	Cir. 8.
29	·497	·545	·599	20·5	39·0	31·9	107	164	182	82	64	90	W b N	N W b W	W	6·12	14·35	11·00	...	...	Str. 10.	Cir. 4.	Cum. 4.
30	·649	·749	·742	29·0	47·6	34·2	161	196	178	89	56	83	W b N	W b S	W N W	12·40	6·29	10·28	...	...	Clear.	Clear.	Clear.
31	·741	·610	·591	31·5	52·1	36·7	167	304	201	83	76	89	W b S	S W b S	S W b S	3·05	1·32	2.05	...	...	Do.	Do.	Do.

Barometer ....
- Highest, the 1st day .... 30·187
- Lowest, the 23rd day .... 29·045
- Monthly Mean .... 29·716
- " Range .... 1·142

Thermometer
- Highest, the 31st day .... 56°·6
- Lowest, the 1st day. ....— 0°·0
- Monthly Mean .... 24°·08
- " Range .... 56°·6
- Mean Humidity............ ·815

Greatest Intensity of the Sun's Rays............ 98°·4

Rain fell on 2 days, amounting to 0,531 inches, raining 7 hours 40 minutes.

Snow fell on 7 days, amounting to 15·60 inches. Snowing 58 hours 10 minutes.
Most prevalent Wind, W b S. Least prevalent Wind, E b N.
Most Windy Day, the 16th day; mean miles per hour, 17·71.
Least Windy Day, the 7th day; mean miles per hour, 0.05.
Aurora Borealis visible on 5 nights. Might have been seen on 8 nights.
Zodiacal Light frequently seen, and was well defined.
The Electrical state of the atmosphere has been marked by very high tension during the month, more especially at the time of the Vernal Equinox.
Ozone was in very small quantities during the month.
First Snipe shot on the 30th April.

Monthly Meteorological Register, Quebec, Canada East, March, 1855.

BY LIEUT. A. NOBLE, R. A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P. M.	10 P. M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Elasticity of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	30·029	29·925	29·915	29·956	14·7	23·8	21·0	19·8	0·077	0·092	0·090	0·086	86	70	78	78	W N W	W S W	W S W	3·8	6·2	3·8	...	...	
2	29·941	·804	·776	·840	18·6	31·5	27·9	26·0	·095	·137	·140	·124	91	78	90	86	W S W	W S W	W S W	5·2	6·2	5·2	...	...	
3	·730	·563	·434	·576	17·7	31·0	29·5	26·1	·092	·154	·157	·134	91	89	96	92	W S W	Calm.	N W	3·8	0·0	5·2	...	0·6	
4	·619	·794	·785	·733	15·0	18·9	11·6	15·2	·070	·088	·062	·073	77	82	78	79	N N W	W N W	Calm.	14·3	7·2	0·0	...	0·8	
5	·453	·214	·080	·249	14·4	34·0	37·2	28·5	·083	·141	·188	·137	93	72	85	83	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	1·0	
6	28·939	·247	·541	·242	23·0	25·3	17·3	21·9	·126	·122	·081	·110	100	87	81	89	N E	N W	Calm.	16·0	11·5	0·0	...	Inap	
7	29·602	·684	·784	·690	5·4	16·8	11·4	11·2	·052	·072	·192	·105	85	73	87	81	W	E S E	Calm.	3·8	2·0	0·0	...	...	
8	·884	·824	·645	·784	9·1	22·3	12·6	14·7	·062	·090	·073	·075	87	74	88	93	N W	Calm.	Calm.	5·2	0·0	0·0	...	...	
9	·409	·338	·461	.403	16·2	24·6	21·5	20·8	·092	·111	·104	·102	95	82	87	88	E N E	Calm.	Calm.	8·8	0·0	0·0	...	Inap	
10	·757	·849	·871	·826	10·2	18·1	11·3	13·2	·060	·078	·074	·071	82	75	96	84	W N W	Calm.	N	8·8	0·0	3·8	...	...	
11	·862	·707	·656	·742	4·6	19·6	17·5	13·9	·053	·096	·083	·077	90	91	81	87	N	E N E	E N E	2·0	13·9	7·2	...	0·1	
12	·626	·677	·877	·727	16·8	29·3	20·7	22·3	·088	·132	·070	·097	91	95	60	82	S E	N W	N N W	3·8	14·7	8·0	...	...	12th. A very fine Aurora visible at 7 p. m.
13	·967	·947	·887	·934	8·6	18·8	17·3	14·9	·050	·063	·059	·057	73	73	58	68	Calm.	E N E	E N E	0·0	16·0	25·4	...	0·1	
14	·858	·884	·910	·884	9·3	13·4	16·1	12·9	·068	·074	·080	·074	96	85	84	88	E N E	E N E	E N E	32·2	34·1	16·0	...	0·8	
15	·828	·574	·335	·579	17·2	22·2	23·5	21·0	·089	·116	·126	·110	89	94	97	93	E N E	E N E	E N E	10·0	30·1	13·9	...	...	
16	·490	·553	·769	·604	30·9	34·2	25·4	30·2	·154	·124	·100	·126	89	63	72	75	N N W	W N W	Calm.	8·8	13·4	0·0	...	...	
17	·873	·735	·529	·712	15·4	24·0	25·5	21·6	·080	·103	·138	·107	87	77	99	88	S W	E S E	E S E	3·8	17·2	21·3	...	4·4	
18	·426	·521	·651	·533	28·1	31·0	28·1	29·1	·155	·139	·125	·140	100	80	80	87	Calm.	W S W	W	0·0	22·7	7·2	...	0·3	
19	·768	·652	·722	·714	19·3	33·0	22·7	25·0	099	·105	·105	·103	91	56	84	77	W	Calm.	Calm.	6·2	0·0	0·0	...	...	
20	·571	·530	·538	·546	19·7	27·8	20·6	22·7	·100	·112	·106	·106	91	72	91	85	E N E	S W b W	Calm.	10·0	7·2	0·0	...	...	
21	·574	·761	·895	·743	16·7	23·5	13·4	17·9	·085	·077	·055	·072	87	60	66	71	W	N W	N N W	6·2	12·9	10·0	...	...	
22	·904	·683	·545	·712	2·6	24·4	15·7	14·2	·044	·071	·070	·062	84	53	75	71	W	S W	Calm.	3·8	6·2	0·0	...	...	
23	·359	·090	28·953	·134	9·7	26·9	23·9	20·2	·063	·128	·117	·103	88	86	88	87	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	11·0	
24	28·779	28·977	29·058	28·938	24·7	14·7	12·2	17·2	·128	·067	·068	·081	94	75	82	84	N E	W b N	W b N	8·8	17·2	39·4	...	2·5	
25	29·134	29·110	·154	29·133	8·0	18·5	19·2	15·2	·057	·071	·074	·067	83	67	68	73	W b N	N W	N W	10·0	17·9	10·0	...	...	
26	·172	·313	·293	·259	16·8	22·0	16·9	18·6	·079	·068	·073	·073	81	57	74	71	N W	W b S	W S W	7·2	7·2	2·0	...	...	26. Lunar halo at 10 p.m.
27	·168	·143	·266	·192	10·9	28·3	17·1	18·8	·063	·096	·066	·075	82	62	66	70	Calm.	W	W N W	0·0	14·7	16·0	...	...	
28	·351	·256	·182	·263	9·9	22·0	21·0	17·6	·059	·080	·112	·084	80	66	96	81	W N W	W b W	W S W	8·0	13·9	10·9	...	...	
29	·126	·165	·321	·204	23·2	36·6	31·0	30·3	·105	·120	·091	·102	81	56	52	66	W	W N W	W N W	15·2	14·3	10·0	...	...	
30	·395	·493	·642	·510	31·2	42·2	30·8	34·7	·119	·142	·156	·139	68	54	91	71	N W	W N W	Calm.	10·0	6·2	0·0	...	...	
31	·602	·478	·409	·496	27·7	44·4	40·1	37·4	·145	·140	·160	·148	75	48	65	63	Calm.	E	W N W	0·0	3·8	3·8	...	...	
	29·555	29·532	29,545	29·5440	15·98	25·91	21·29	21·06	0.087	0·104	0·103	0·098	87	73	80	80				6·97	10·21	7·00	...	21·6	

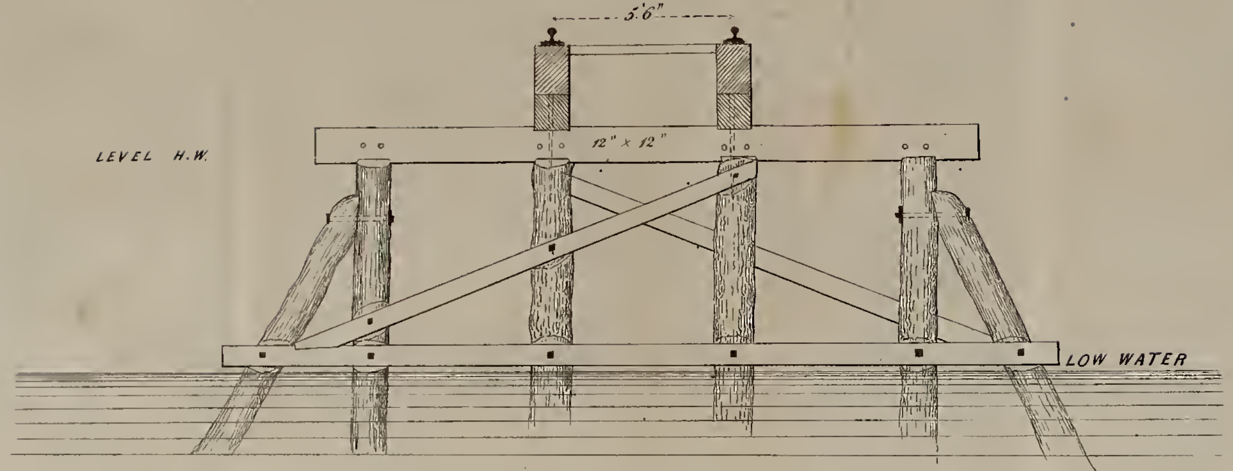
Maximum Barometer, 6 a.m. on the 1st	30·029
Minimum Barometer, 6 a.m. on the 24th	28·779
Monthly Range	1·250
Monthly Mean	29·5440
Maximum Thermometer on the 31st	47°·3
Minimum Thermometer on the 22nd	2·4
Monthly Range	44·9
Mean Maximum Thermometer	28·29
Mean Minimum Thermometer	11·87
Mean Daily Range	16 41
Mean Monthly Temperature	21·06

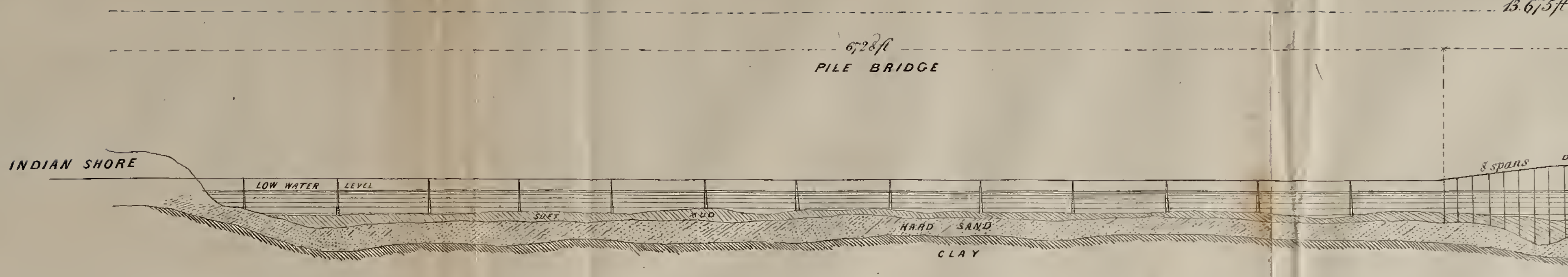
Greatest Daily Range of Thermometer on 24th	24°·6
Least Daily Range of Thermomter on 14th	8°·8
Warmest Day, 31st. Mean Temperature	37·4
Coldest Day, 7th. Mean Temperature	11·2
Climatic Difference	26·2

Possible to see Aurora on 12 Nights.
Aurora visible on 11 Nights.
Total quantity of Rain, ·000 inches.
Total quantity of Snow, 21·6 inches.
No Rain fell.
Snow fell on 12 days.

No 3.

CROSS SECTION PILE BRIDGE



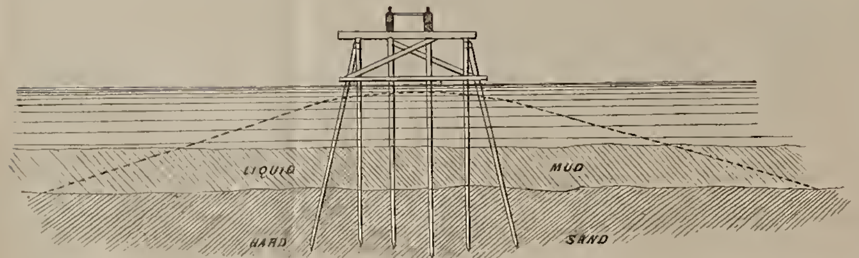


No 1.

SECTION OF RICE

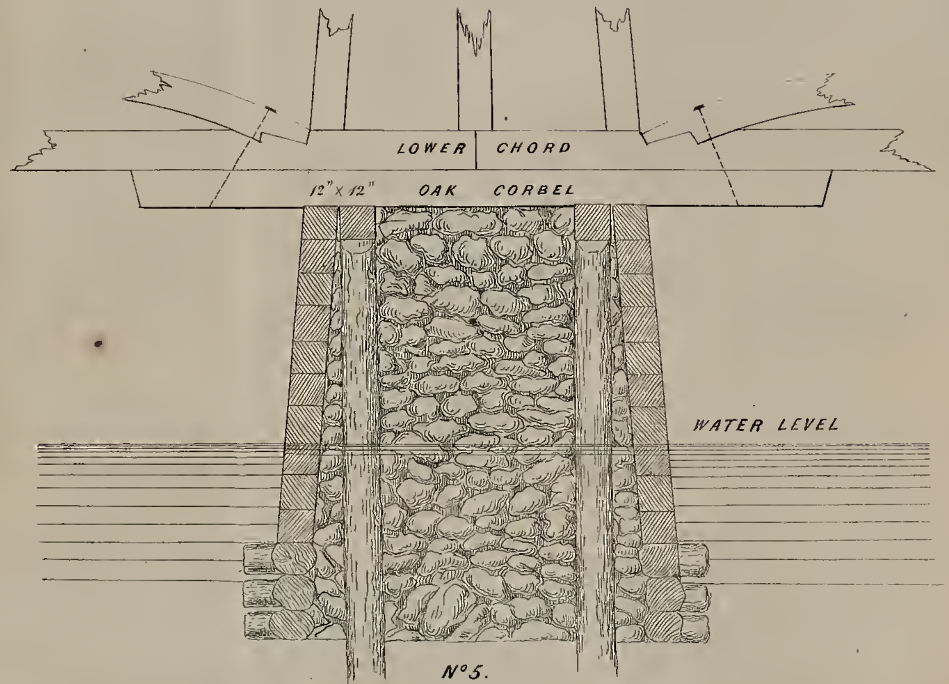
SCALE HORIZONTAL 600 feet to one i
VERTICAL 60 " " "

No 6.



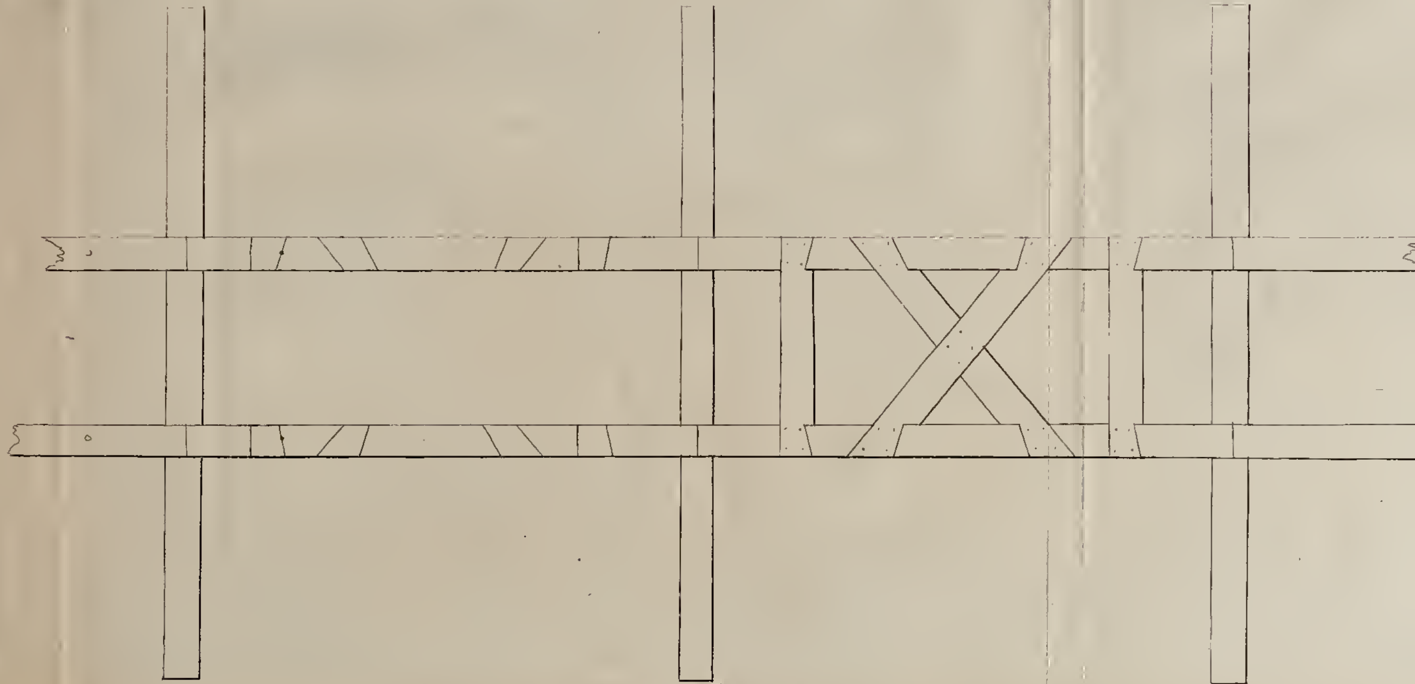
CROSS SECTION OF PILE BRIDGE

after being filled to one foot of low Water with earth.



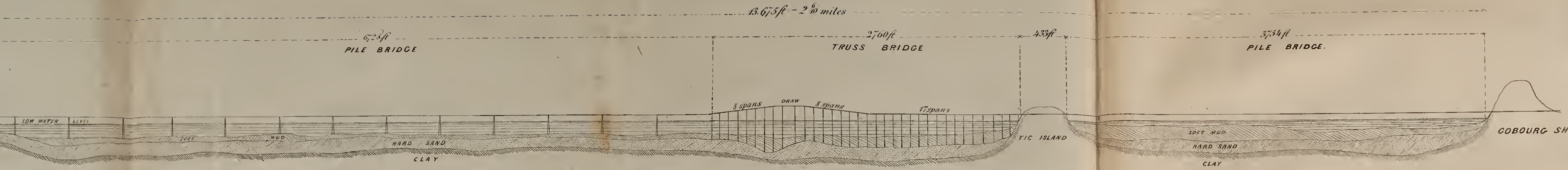
No 5.

LONGITUDINAL SECTION OF PIER



No 4.

PLAN OF PILE BRIDGE.



Nº 1.

SECTION OF RICE LAKE

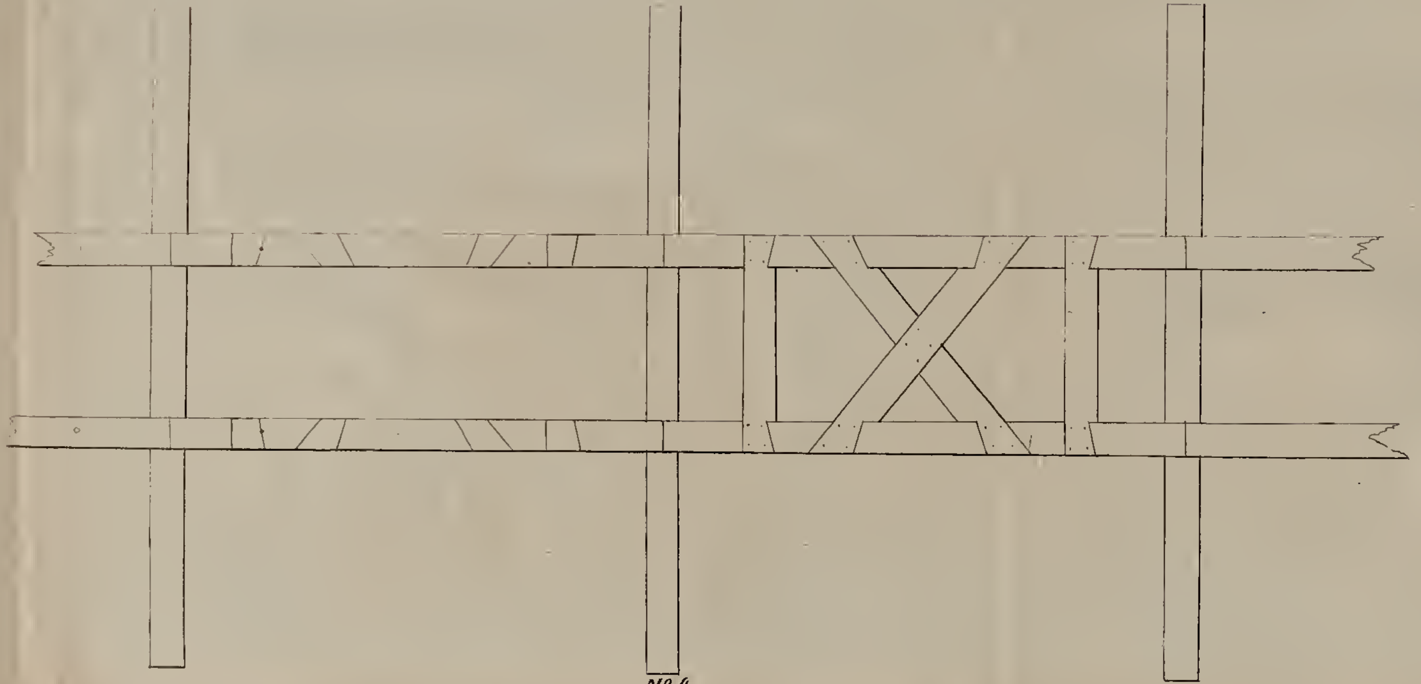
SCALE HORIZONTAL 600 feet to one inch.
VERTICAL 60 " " " "

Drawings of RICE LAKE RAILWAY BRIDGE,

to accompany a Paper

by T. C. Clarke C. E.

For the "Canadian Journal."

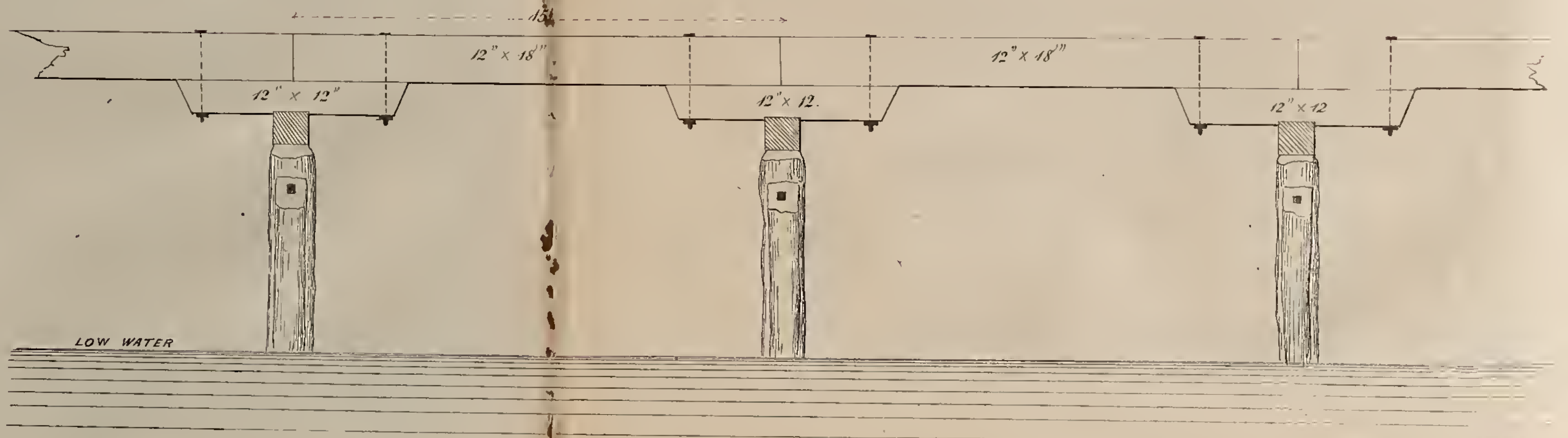


Nº 4.

PLAN OF PILE BRIDGE.

Nº 2.

ELEVATION PILE BRIDGE.



The Canadian Journal.

TORONTO, JUNE, 1855.

On the Action of the Ice upon the Bridge at Rice Lake.

By T. C. Clarke, C.E.

(*Communicated to the Canadian Institute, April 21st*, 1855.

The bridge of the Cobourg and Peterboro' Railway over the Rice Lake, in the county of Northumberland, is perhaps the largest Railway bridge on this continent, and one of the largest in the world,—its total length being a trifle over two miles and a half. The Railway crosses from the Cobourg shore to Tic Island by a pile bridge of 3,754 feet in length. Here it curves a little, the deflection being 2¼°. From Tic Island to the north side of the main channel, a distance of 2,760 feet, there is a succession of wooden cribs 10′×20′ in size, sunk eighty feet from centres, filled with stone, and carrying a superstructure of that class of bridges known as "Burr's Truss."

In the channel, there is a pivot draw on a turntable, supported by a pier 20′×40′ in size, and giving two openings of fifty feet each. The bridge raised on an incline from each end towards the draw, and the spans immediately next it, give a clear headway of twelve feet, to afford a passage for the cabins built upon the rafts which come down the Lake.

From the end of the truss bridge to the Indian village shore, a distance of 6,728 feet, is a pile bridge, similar to the other, except that it is strengthened every five hundred feet by a crib 10′×20′ in size, loaded with stone. The cross section of Rice Lake accompanying this paper, shows these dimensions of the bridge.

The bottom of Rice Lake is black mud, in a semi-liquid state, and capable of affording no support to piles. This sometimes reaches nearly to the top of the water, and sometimes there is a depth of ten to fifteen feet of water before reaching it. It affords nutriment to the wild rice (Zizania aquatica. L.), from which the Lake takes its name, and which grows in large patches in such luxuriance that it is difficult to paddle a canoe through it. Under this black mud there is a stratum of very hard and compact sand, overlaying the clay.

The depth of water and mud averaged from the low water level, shown in the section, is about fourteen feet south of Tic Island, and sixteen feet between the Truss bridge and the Indian shore. The total rise and fall of the Lake is six and a half feet.

The piles are driven through the sand and a little into the clay, in some instances; generally, however, they are driven an average of ten feet into the sand, which was a difficult process; the pile not going more than two inches at a blow, from rams weighing 18 cwt., falling through forty feet leaders, after it had begun to penetrate this sand.

It will be observed that from Tic Island to the channel, where was evidently the ancient bed of the river, it is deeper than the rest of the Lake, being an average of twenty-eight feet from low water mark. In the channel it is thirty-six feet from low water mark, and forty-two and a half feet from high water mark to the hard bottom. This depth rendered an ordinary pile bridge impracticable, and accordingly the truss bridge, resting on crib piers, as before mentioned, was designed to carry the Railway over this part of the Lake.

The mode of construction was as follows:—Four long piles were driven and capped, to bear the vertical pressure of the bridge until the cribs could sink to their bearings. They also served as guides for the cribs, which were built around them, 10′×20′ in size at top, and battening 2″ in 12″ at the ends, and 1″ in 12″ at the sides. They were made of square timber above, and round below water. They were sunk to their places through the ice in winter, and then loaded with bowlders, collected along the shores.

The construction of the pile bridge will be seen from inspection of the accompanying drawings. The piles, of which the centre pair were white oak, the outside pair and the spur piles in some cases pine or tamarac, were driven, and capped with pine caps 12×12. The spur piles were driven with a leaning machine, so that their tops stood about four feet from the others. They were then drawn up by strong tackle, and secured with 1″ round bolts. The corbels are fastened to the caps and piles by 1″ square rag bolts three and a half feet long. They are notched an inch on the caps. The stringers of pine, 12″×18″, are secured to the corbels by 1″ round screw bolts. Ties of 3″ oak plank connect the stringers together on top.

The quantities of materials in this bridge are as follows:

184,000 lineal feet of piling.
138,000 " " round timber in cribs.
644,000 feet B. M. square " "
1,932,000 " " " " in bridge.
250,000 lbs. iron in bridge.
20,000 yards stone in cribs.

The total cost of the bridge has been not far from $175,000.

It remains now to describe the effect which the ice has already had upon this structure, and to consider what are its future prospects of stability and permanency.

It was predicted by many persons, previous to commencing this undertaking, that no structure could possibly be built which could resist the power of the ice in Rice Lake,—which forms to the thickness of two and a half feet; expands with such force as to "buckle" up into high ridges, from the heat of the noonday sun; and contracting again in the cold nights, cracks and splits with a noise like that of artillery, and with a tremendous power which, as they declared, no artificial structure could resist. Moreover, they said, after the ice has "taken," the lake rises some two or three feet, and the ice, being frozen to the piles, must inevitably drag them all out.

To these evil forebodings it was replied that it was not supposed that a pile bridge could sustain the thrust of the ice for any length of time; it might be disturbed and thrown out of line and level, but notwithstanding it could serve to carry the trains across the lake until such time as it could be filled up with a solid embankment. It was not expected that it would last for ever; but if it lasted long enough to form a means of communication across the Lake until it was filled up from dirt waggons, that would be a great advantage,—sufficiently important to justify the cost of the bridge. To be sure, if the Company had plenty of time, and unlimited means, it would be better to fill the Lake up as they went along, leaving only a passage for the waters; but, in their circumstances, this was entirely impossible, for it would have required such a large immediate outlay, with so remote a prospect of remuneration, that the project would have been killed.

The bridge was accordingly built, and the result has thus far justified the anticipations of its projectors; while, on the other hand, the prognostications of those who feared danger from the ice have been partially realized. The bridge has been much twisted and shaken, but although its straightness and regularity have been destroyed, it still stands in its place, fully equal to the task of carrying unusually heavy engines over in safety.

If the filling in of the Lake is hurried on with as fast as possible, it can be completed before next winter, and then there will be no danger to be apprehended for a long time to come.

The manner in which the ice has affected the bridge is somewhat singular. As was predicted, there has been evidently a raising of the entire field of ice since its formation. The effect of this during the winter of 1853–4 was to draw out a few piles, near the Indian shore, which had been imperfectly driven, and to raise the whole, north of the truss bridge, some six or eight inches, except where it was held down by the cribs, sunk every five hundred feet. This gave it rather an undulating surface, and they were obliged to raise and block up the stringers at these low points. It is proposed to prevent this raising of the ice, by putting flash-boards on the dam at Crook's Rapids, at the lower end of Rice Lake, and raising it some two or three feet before the ice takes. As more water flows into the Lake it would be necessary to gradually take off the boards, and thus keep it at the same level.

When there is no snow on the ice, the heat of the sun in the middle of the day expands it, and it moves slowly, carrying the bridge with it. When night comes on and the temperature falls, it contracts again, and cracks and splits in a surprising manner.

One of these cracks took place at a very acute angle across the bridge, throwing one portion up stream about eighteen inches, and the other down as much.

The worst injury that the bridge has received was about the 1st of January of this year. The weather was particularly trying, the days being warm and the nights very frosty; and this, it must be observed, is the only kind of weather in which the bridge takes injury,—uniformly cold or warm weather not affecting it.

On this occasion there appeared to be an expansion of the ice from the channel towards each shore, and the effect was irresistible. The pile bridge north was thrown towards the Indian shore; but owing to the number of cribs in it, it moved but little. The truss-bridge was pushed towards Tic Island, so that the last span slid four feet upon the solid abutment. South of Tic Island, the pile bridge was crowded over toward the Cobourg shore,—so much, that at the place where it parted, near the island, the stringers were drawn apart nearly seven feet, so that they fell from the corbels. The piles were leaned over, and where the thrust met the resistance of the shore, it crushed up the solid $12'' \times 18''$ stringers, and turned them into splinters, and bent the iron rails double. This has all been since repaired, and the trains are now crossing regularly.

From inspection of the drawing, No. 6., accompanying, it will be seen that nearly three-fourths of the length of the piles are unsupported, and only one-fourth of them is in the solid ground. When the thrust of the ice comes at the water-line, it exerts a very powerful leverage, and it is not strange that the bridge should yield.

The dotted line in fig. 6 shows the outline of the embankment which it is proposed to make. This, it will be seen, will support the piles very much, and render it almost impossible that they should be moved. In course of time, as the piles decay, it will be found necessary to fill it up to the level of the track. The embankment must then be protected from washing away by a slope wall of loose stones and brush. Another very ingenious method of protecting it has been proposed, which would be less expensive than a slope wall. This is, to drive piles some twenty feet from the bridge in rows parallel to it on each side, cut them off below the depth to which the ice forms, and chain to them a succession of spars forming a boom along the embankment on each side, and twenty feet from it. It is believed that this would render the water calm enough inside of it to prevent washing away the bank.

The material on the south side of the Lake is admirably adapted for filling, being a tough species of clay, or rather hard pan, which, when thrown into the water, consolidates, and packs around the piles, instead of washing away. A few hundred feet of embankment was made of this material in the summer of 1853, and has stood perfectly well ever since.

The Rice Lake Bridge was designed and built under the immediate superintendance of Ira Spalding, Esq., and reflects great credit on that gentleman's skill and judgment as an Engineer. The contractor was Mr. Zimmerman, whose well known energy was severely taxed to supply so large an amount of materials, and carry on the work to successful completion, in spite of sickness and scarcity of workmen, in the comparatively short space of eighteen months.

THOS. C. CLARKE.

Port Hope, April 2nd, 1855.

Report of the Select Committee on the Geological Survey of Canada.—Minutes of Evidence.

In continuation* of the "Report of the Select Committee" appointed by Parliament to inquire into the condition of the Geological Survey of Canada, we proceed to furnish an abstract of the Minutes of Evidence which accompanied the Report. The importance which the Committee have very properly attached to this great undertaking is thrown into relief, not so much by the information elicited from witnesses respecting the actual results of the Survey, as by the proofs of a marked and highly complimentary attention, which the labors of Mr. Logan and his staff have met with among European and American Geologists and practical men.

The first witness examined was Professor Hall, of Albany, the author, among other valuable works, of the "Geology of the First District of the State of New York," and of those magnificent volumes devoted to the Palæontology of the entire State. Mr. Hall submitted in evidence that he had had an opportunity of knowing much of the progress of the Canada Geological Survey from its commencement, and entertained a very high opinion of the character and value of the work which has been accomplished, as well as of its importance to the Province, both in its Scientific and Economical relations.

In reply to the question, "What in your opinion would be the best manner of placing the information and materials that have been collected on the Canadian Survey before the public?" Mr. Hall considered it advisable to publish in one or more volumes an account of the Geology of the Province, which may be a revision and a condensation of the Reports of Progress, with such illustrations by Geological Sections, Maps, Fossils, &c., as may be required for the proper elucidation of the subject. Accompanying this volume should be a Geological Map of the Province on a scale sufficiently large to represent all the Geological formations in their entire extent, each formation being distinguished by a different color. This map might also be accompanied with a small Pamphlet, describing briefly the character and extent of the Formations as represented on the map by different colors. It would be very desirable to have copies of the complete work and the map so distributed that it would be accessible for reference to every

* See "*Canadian Journal,*" Vol. III., p. 234.

person in the Province. In addition to this means of placing before the public the information already obtained, he strongly recommended that the Museum already commenced should be advanced as rapidly as consistent with the other duties of the Geologist. The object in this collection should be the formation of a Museum of Economic and Scientific Geology, where specimens of all the Mineral products of the Province should have a place; and where those of Economic interest should be presented in a proper arrangement, not only in their natural state, but also in their wrought or manufactured condition.—This Museum should be open to the public. This plan would render available at an early period a great part of the information and materials already collected by the survey. The publication of the results of the Survey, as the materials accumulated, was recommended,—since by such a course the Canadian Survey will receive due credit for such discoveries, and confer a benefit upon science by their speedy publication; whereas by leaving the publication till a later period, the same discoveries may be made and published elsewhere.

A sound basis of scientific investigation is of the highest importance in leading to practical results. Mr. Hall said that he conceived that no practical or economic results of great value are likely to arise except those based upon scientific investigations. The great lead-bearing formation of the States of Wisconsin, Illinois, and Iowa was instanced. For many years a serious misapprehension existed in regard to the true position of the lead-bearing rock; and only so late as 1850 was it determined, by a proper examination of its organic remains, that instead of its being in the Niagara group, as formerly supposed, it belongs to a much lower series of rocks, viz., a Lower Silurian Limestone. This erroneous impression gave rise to fruitless searches for Lead ore in the Niagara limestone, which this late information will discourage. There are at this time multitudes of practical miners, who know at once, by the occurrence of certain Fossils, the presence of the Lead-bearing rock, and who would never think of searching for Lead ore in any rock where these Fossils do not exist.

During fifty years previous to the commencement of the Survey in the State of New York, not less than one million dollars had been expended in abortive search for coal, where a well-informed Geologist would have at once pronounced the undertaking useless, and certain to prove a failure.

With reference to the Mineral wealth of Canada, Mr. Hall stated that "from a knowledge of the great Geological features of Canada, derived chiefly from the Reports of Mr. Logan, as well as from some cursory observations of my own, I infer that the Country is rich in all those Mineral products (with the exception probably of coal,) which lie at the foundation of modern progress and civilization. Without enumeration, I need only refer to the list of Economic Materials given in the Geological Report of 1849-50, and to the display of mineral products in the Canadian department of the Grand Industrial Exhibition of London in 1851. I might mention, however, the immense area of the Geological formation composing the Laurentine mountains on the north of the St. Lawrence, having a length of one thousand miles by a breadth of one hundred miles, in which occur deposits of magnetic Iron Ore, the most extensive and valuable in the known world. This ore, so famous in Sweden for the manufacture of steel, is associated in the same formation with specular Iron Ore, Galena, Plumbago, indications of Corundum, and other mineral products. Succeeding this, you have a large area of Copper bearing rocks of the Lake Superior region, in which both Copper and Silver occur. You have also some forty or fifty thousand square miles of country on the south of the St. Lawrence, composed of Metamorphic rocks of a later age. Ten thousand square miles of this area have been shown to contain Gold, and the entire formation abounds in Magnetic and Specular Iron Ores, Chromic Iron, Copper Ore, Serpentine, Marble, Soapstone, Roofing Slates, and many other economic products. In the other formations, comprising half the entire area of Canada, are abundance of Limestones and other building stones, Clays, Ochres, Bog Iron Ores, Asphalt, Gypsum, &c., &c.

"Compared with the neighbouring States, Canada stands before any one of the United States, except those containing coal; but taking all the States upon her borders together, the comparison in everything, except coal, is very nearly equal, if we compare equal areas of country."

The next witness examined was Professor E. J. Chapman, of University College, Toronto.

Ques.—"Have you ever been practically engaged in any Geological Surveys? *Ans.*—"Yes, in several; *principally for Railway and Water Companies.* I have also taken part in Mining Surveys; and I may mention, as lending more weight to my evidence on this occasion, that I am the author of several works on Mineralogy, and of a considerable number of published papers on Mineralogy, Mineral Chemistry, and Geology, many of which have been translated into foreign scientific Journals." We may, perhaps, be permitted to question whether the implied comparison between a Geological Survey for "Railway and Water Companies," and the Geological Survey of Canada—a vast country containing 300,000 square miles—is either philosophical or just; a doubt which is far from being dispelled by the perusal of the question and answer subjoined, in which "waterways," "millstreams," and "dumbwells" are brought forward as illustrations to sustain the prosecution of an inquiry which, though it may cost the country fifty thousand pounds, will at the same time add immeasurably to its wealth and its science.

Can you give instances from your own experience in such surveys of the practical importance of results which at first sight might appear to be exclusively of scientific interest? *Ans.* Many instances of this kind are well known to Geologists, some have come under my own observation; when a railway crosses a stream in England, the law compels the Company to make the water-way sufficiently large to prevent the land around from being flooded during times of heavy rain, or from the melting of the snow. It is very frequently inconvenient to the Engineer to make the water-ways larger than is absolutely necessary; and the usual method of procedure is to measure the nearest existing water-ways, ascertaining at the same time from persons living near the spot, if these be of sufficient size to admit at all times the flow of water through them. When engaged some years ago in this kind of work, I was surprised to find the water-ways over a small stream quite insufficient to prevent flooding, when from another stream in the same locality with smaller water-ways, no flooding took place; the physical aspect of the country exhibiting no cause for the difference in question, but rather tending the other way. On examining the district geologically, however, the problem was explained at once. The hills and higher ground along the one stream were capped with stiff impermeable clay; along the other, with gravel. All the rain which fell upon the clay, apart from that taken up by vegetation, ran off into the stream; whilst the greater part of the rainfall upon the gravel was absorbed by the porous nature of the soil. *Now had a geological survey of such a district been made before the erection of bridges, it would have shewn that the water-ways over the one stream must have been very much larger than those over the other, if flooding were to be avoided.*

Another case, much of the same kind, came under my notice more lately, whilst prosecuting some Geological inquiries in Hertfordshire. A miller inquired of me why the stream on which his mill was situated, after having been at one time sufficient to drive eight pairs of stones, had gradually become unable to drive more than three pairs; thus

greatly deteriorating the value of his property. The surrounding country was clay overlying porous chalk. On examining into the matter, I found that an extended system of drainage, by means of the so-called "dumb wells," had come into operation in the district during the preceding three or four years, and had thus gradually affected the water power of the stream. These dumb wells are pits dug through the clay into the absorbent chalk, and afterwards filled up with rounded stones or other matters admitting the free passage of water. Drains being led into these, the greater part of the rain-fall is carried into them, and so down into the underlying porous rock. *Whenever therefore a Geological investigation of a district points out the existence of permeable beds, lying at an accessible depth beneath stiff clay lands, and good surface drainage is not readily obtainable, recourse may be had to the method just described.*

We cannot consider these "instances of scientific results acquiring practical importance" very flattering to our Geological Survey, or likely to win for it a cheerful support and encouragement from the practical men of Canada.

With reference, indeed, to the first illustration, it does not seem to be very improbable that an hour's inspection of the water marks on the banks and in the valley of the streamlet would have furnished the information to be deduced from "a Geological Survey of such a district before the erection of bridges;" such, we apprehend, is the modest plan which would have been adopted in Canada; and as to the existence of available 'permeable beds,' the first well sunk in a district must lead to their discovery. Hundreds of mill-streams in this country are annually failing in their supply of water, and at the same time freshets are becoming more sudden and destructive, yet no one would venture to advocate the expediency of sustaining a geological survey with a view to arrive at the explanation of these frequent and easily interpreted occurrences. Mr. Chapman, however, was asked to give instances from his "own experience in such Surveys of the practical importance of results which at first sight might appear to be exclusively of scientific interest," and with commendable candour he limited his instances to those which had come under his independent observation; not that the illustrations advanced can be said to be possessed of much scientific value to the geological world, however important they may have appeared to a Hertfordshire miller; yet, experience is always worth consulting, whether won in the difficult pursuit of truth at the bottom of "dumb wells," or acquired by the patient study of the water shed of a refractory streamlet.

Ques.—"Have you had an opportunity of ascertaining the progress that has been made in the Geological Survey of this Province; and what is your opinion of that progress?" *Ans.* "I have devoted several days to a very careful examination of the work already performed, and the materials collected under Mr. Logan's direction, and I can only express my wonder that so much should have been done; considering more especially the small means hitherto at Mr. Logan's disposal, the want of Topographical Maps, and other difficulties incidental to a new country." No one would suppose that a just appreciation of the value of the results already obtained by the Survey, could be derived from an inspection even during broad-day light of the minerals collected, as they may have been obtained from localities commercially inaccessible; but, when they "lie in a great measure, buried in packing-cases in the vaults and sheds of the Survey Office,"* the difficulty is proportionately increased. It is only by a study of the published reports of the work already done, that correct impressions can be obtained of the real value of the Survey. We confess, therefore, to some degree of surprise at finding Mr. Chapman state in the continuation of his evidence, that "several of Mr. Logan's valuable reports, moreover, are out of print, and *I have been quite unable to obtain copies of them.*" This explains at once the error alluded to in the May number of this Journal respecting the discovery of the tracks of a crustacean in the Potsdam Sandstone, the inference being that Mr. C. was not familiar with the contents of the Reports of which he had been unable to procure copies.

Mr. Chapman is asked by the Committee to state some of the new Scientific Truths which have been derived from the Survey, and he enumerated among others the following:—"Another very interesting discovery is that of the crustacean tracks on the Potsdam Sandstone. The celebrated discussion to which this has given rise in England has attracted the attention of scientific men all over Europe to the results of the Survey." Had Mr. Chapman enjoyed the opportunity of studying Mr. Logan's admirable Report for 1851 and '52 he would have known the name and designation of the real discoverer; or had he met with the fourth edition (1852) of Sir Charles Lyell's Manual of Elementary Geology he would have found the following circumstantial notice of the "tracks," with the date of the discovery, and thus avoided leading the Committee into error on a subject familiar to every amateur geologist in Canada:—

"*Tracks of a Lower Silurian Reptile in Canada.*"—In the year 1847 Mr. Robert Abraham announced in the *Montreal Gazette*, of which he was editor, that the track of a fresh water tortoise had been observed on the surface of a stratum of sandstone in a quarry opened on the banks of the St. Lawrence at Beauharnois in Upper Canada. The inhabitants of the parish being perfectly familiar with the track of the amphibious mud-turtles or terrapins of their country, assured Mr. Abraham that the fossil impressions closely resembled those left by the recent species on sand or mud. Having satisfied himself of the truth of their report, he was struck with the novelty and geological interest of the phenomenon. Imagining this rock to be the lowest member of the old red sandstone, he was aware that no traces had as yet been found of a reptile in strata of such high antiquity. He was soon informed by Mr. Logan, at that time engaged in the Geological Survey of Canada, that the white sandstone above Montreal was really much older than the "Old Red" or Devonian. It had in fact been ascertained many years before, by the State Surveyors of New York (who called it the "Potsdam Sandstone"), to lie at the base of the whole Silurian series." * * * Early in the year 1851, Mr. Logan laid before the Geological Society of London a slab of this sandstone from Beauharnois, containing no less than twenty-eight foot prints of the fore and hind feet of a quadruped, and six casts in plaster of Paris, exhibiting a continuation of the same trail. * * * Numerous other trails have since been observed (1850, '51), in various localities in Canada, all in the same very ancient fossiliferous rock; and Mr. Logan, who has visited the spots, will shortly publish a description of the phenomenon." We may here remark that Professor Owen first inferred (1851) that the tracks were those of a fresh water or estuary tortoise. Agassiz supposed that they were crustacean, in which view Professor Owen coincided in 1853. (See Journal of the Geological Society August, 1853.)

Mr. Chapman being requested to state to the Committee some of the advantages derived from the Survey by the discovery of materials of economic application, replied:—"With regard to economic discoveries, I may state generally that the survey has brought to light the existence of beds of workable

* See Report of Committee.

Peat, before, I believe, unknown in Canada, or at least undescribed, of slate of excellent quality, of limestone bands, where limestone was supposed to be absent, and of lithographic stone, serpentine, soapstone, white brick clay, and other valuable materials, previously altogether unknown or undiscovered along the localities indicated by the survey. * * * * The proof of the non-existence of coal over the greater part, if not the whole of Canada, is entirely due to the survey." Why did not Mr. C. enumerate the Copper region of Lake Superior and Huron, the vast deposits of gypsum in western Canada, the enormous areas of magnetic, bog and specular ores of iron some sixty miles north of Lake Huron, also in the valley of the Ottawa and the valley of the St. Lawrence? Why not mention the great ranges of building stone, as well as 'serpentine'? beautiful ochres and admirable sandstones for glass-making as well as 'soapstone'? Marble, manganese, and refractory sandstone as well as 'white brick clay'? and would it not have been as well to have hinted at plumbago, phosphate of lime, flagstones and shell marl, as "the bringing to light the existence of workable beds of peat"?

We most cordially agree with Professor Chapman in his recommendation, that at least from 10,000 to 20,000 copies of the Reports should be struck off and distributed among "the schools, mechanics' Institutes and other similar establishments throughout the Province;" and may we not add, among the Professors of Mineralogy in our Colleges!

W. E. Logan, Esq., Director of the Geological Survey of Canada, gave a short statement of what he had accomplished up to the present time, which we give below :—

It will be observed by a reference to the Reports of Geological Progress published, that the districts examined are as follows:

The Canadian coast and Islands of Lake Superior, and two rivers on the north shore for distances of forty and sixty miles up. Here there has been shewn to exist an important copper region.

The Canadian coast and islands on the north shore of Lake Huron with distances of from twenty to seventy miles up four of its principal tributaries. Along the coast the copper-bearing rocks have been shewn to continue to some distance eastward of Lacloche.

The coast of Lake Huron from the mouth of the Severn round by Matchedash Bay, and Cabots Head to Lake St. Clair; that of Lake Erie from the vicinity of Chatham to the exit, and the upper part of Lake Ontario; with most of the country included in the perimeter formed by these coasts and a line from Toronto to Lake Simcoe. In this have been shewn great ranges of valuable building stone, of gypsum, and hydraulic and common limestone, with extended areas of white and red brick clay, bog iron ore, asphalt and mineral oil; while the structure, proved by the ascertained distribution of the formations, shews that there can be no workable coal beds in a part of the country, where even practised observers, without due caution, would be liable to mistakes that might lead to great loss of capital.

The country in a general line between Lake Simcoe and Kingston along the junction of the fossiliferous and unfossiliferous rocks; in the former of which are shewn the existence of a great range of valuable building stone, as well as hydraulic and common limestone, with lithographic stone; and in the latter enormous deposits of magnetic iron ore with whetstones, plumbago, crystalline lime-stone and other materials; while the drift displays great areas of white and red brick clays, in some places covered by extensive tracts of excellent peat and shell marl.

The country between the St. Lawrence and the Ottawa, south of a line from the vicinity of Kingston to Pembroke, comprising a surface of about 10,000 square miles, where in addition to great areas of peat and shell marl, and clay fitted for common bricks and pottery, with bog iron ore and ochre, great ranges of building stone, hydraulic and common limestone, and white sandstone fitted for the purpose of glass making, in the fossiliferous rocks; and magnetic and specular ores of iron, lead ore, and some copper ore, plumbago, phosphate of lime, great and extensive beds of crystalline limestone, sometimes giving good marble, barytes and traces of corundum have been found in the ins fosiliferous.

The Ottawa from its mouth near Montreal to the head of Lake Temiseamang, a distance of 400 miles, with many of its tributaries on the south bank for distances of from twenty to forty miles up. The economic materials in this are similar to those in the previous area and in equal abundance.

The north side of the St. Lawrence from Montreal to Cape Tourmente, as far back as the junction of the fossiliferous and unfossiliferous rocks, comprising an area of 3000 square miles, in which have been found clay fit for common bricks and pottery in great quantity, accessible in almost every part; bog iron ore in large abundance, a profusion of iron and manganese, ochres of various beautiful tints, tripoli or infusorial earth, refractory sandstone admirably adapted for furnace hearths, white sandstone fit for glass making, ranges of excellent building stone extending the whole distance, marble, and limestone fit for burning.

The south side of the St. Lawrence and the Eastern Townships from St. Regis to Etchemin River, a surface of about 15,000 square miles, a large portion of which is occupied by a mineral region of great importance, found to hold inexhaustible supplies of roofing slate and of beautifully variegated calcareous, and magnesian marbles, the latter resulting from a band of serpentine which has been traced for 135 miles, soapstone in great abundance, dolomite, magnesite, chromic iron, whetstones, extensive intrusive masses of most beautiful granite, magnetic iron ore, occasional indications of silver-bearing lead ore, copper ore and gold, while in the less mineralized part are good arenaceous and calcareous building stone, flagstone, white sand, stone for glass making, common brick and pottery clay, bog iron ore, peat, shell marl, and other materials.

The country between the Etchemin River, and Temiscouata portage road, in which many of the same materials as in the previous area will be found, but cannot yet be pointed out in a connected manner, the exploration having been only partial.

The coast of the Gaspe Peninsula from the Metis road by Cape Gaspe and Isle Percee to the mouth of the Matapedia River, a distance of about 800 miles, with several sections across the Peninsula from the St Lawrence to Bay Chaleurs; the chief object of the exploration of this district was to determine the northern limit of the great eastern coal field of North America, spread out in the sister colonies; and as the carboniferous area lies unconformably on the inferior rocks, to ascertain whether any outlying patches might exist in the Peninsula. None such, however, have yet been discovered.

A large and valuable collection of specimens has been made to illustrate the economic materials, the minerals, rocks and fossils of the districts examined. This is preserved at the office of the Survey; and now that a suitable building has been placed by the Government at the disposal of the Survey, a commencement had been made to a classification and arrangement of the materials into two divisions, one to display the character and application of the useful materials, and the other the science of the whole subject.

The true bearing of geological facts, as parts of a whole, being unintelligible without the exhibition of their relative geographical positions, and so large a portion of Canada being still unsurveyed topographically, it has been necessary to measure accurately extensive lines of exploration, and the maps resulting have proved of great value to the Crown Land Office. From this collateral work is derived a large part of what is known of the interior of the Gaspé Peninsula, where six streams have been measured; the Matane, the Chat, the St. Ann, the St. John, the Bonaventure and Great Cascapedia. It has shewn the courses of the Kamanistiquia and Michipicoten rivers on Lake Superior; of the Thessalon, the Mississague, the Spanish and French rivers, on Lake Huron; in addition to 150 miles of the Ottawa and the whole length of the Mattawa. From it has resulted the improved delineation of the forms aud distribution of a great chain of lakes in the rear of Kingston, and last year the course of the Muscoco from Lake Huron to its source; of the Petewawe from its source to its mouth; of the Bonnechere from its junction with the Ottawa to one of its sources; of the York branch of the Madawaska, with a sketch of the relations of various streams, from the tributary just mentioned to Balsam lake, the whole distance in these explorations and admeasurements being 500 miles.

Chemical analyses have been made of all the metallic ores, and such other useful minerals as required it, the number of which has been very great, and in addition of upwards of fifty valuable mineral springs, of a great collection of soils from both divisions of the Province, and of new mineral species.

The means placed by the government at Mr. Logan's disposal were £1,500 in the first instance, then £2,000 per annum for five years from March, 1845; £2,000 per annum for five years from July, 1850; and £1,000 for fitting up the Museum, making a sum total of £22,500 for the whole expenses of the Survey during a period of eleven years. The Survey of the State of New York cost half a million dollars. From want of a liberal grant Mr. Logan has been compelled to supply at his own expense nearly all the scientific books indispensible for the proper prosecution of the Survey, and all the more costly instruments required both for topographical surveying and chemical analysis, and has in various other ways met the deficiencies of the government appropriation from his private exchequer. While enumerating these difficulties he is not unmindful of his friends. He reminds the Committee that the present increased value of all the necessaries of life press severely on those associated with him in the investigation. The physical difficulties of the Survey have been both numerous and constant; besides those incident to travelling in canoes up shallow rivers, and travelling on foot through the forest, the endless measurements and remeasurements arising from the want of a good topographical map of the country have been a serious labour in themselves, and retarded in a very great degree the progress of the geologists. "Boundary lines that on paper are represented as straight go staggering through the bush in zigzags that would surprise an Indian hunter."

The work of the Survey is too extensive for the staff employed on it. All the general office work falls on Mr. Logan; he keeps a set of books by double entry, detailing every penny expended on the Survey and the purpose to which it is applied. Formerly he was accustomed to write with his own hands four manuscript copies of his report, often amounting to more than 100 printed pages. The present staff consists of a director, (Mr. Logan) an assistant geologist, (Mr. Murray) a chemist and mineralogist, (Mr. Hunt) an explorer, (Mr. Richardson) and a messenger. The staff now proposed by the Committee is mentioned in their report. (See May No. of *Canadian Journal*.) Mr. Logan renders public thanks to Mr. Abraham, Dr. Wilson, the Rev. Mr. Bell, Mr. Billings and Mr. Sheriff Dickson for the valuable information they have from time to time communicated to him. "An excellent vein of geological knowledge seems to run up the Ottawa." Specimens of minerals and rocks have been occasionally sent to the Crown Land Office from provincial surveyors for transmission to Mr. Logan but have not yet reached the office of the Survey. The packages having been opened, and probably handled by several persons, the labels may have been misplaced, and thus a doubt becomes attached to the whole of them which destroys their value. This advantageous method of obtaining, without expense or trouble, much valuable information respecting the geographical distribution of various rocks, has hitherto been of no avail through the want of method and co-operation on the part of the authorities of the Crown Land Office.

Illustrations of the practical value of the Survey are occurring every day. The information contained in the reports has led to the establishment of the iron works of Forsyth & Co. at Bytown. These gentlemen (from Pittsburgh) express their thanks to Mr. Logan for his information in leading to and assisting their present enterprise. Mr. Keefer ascertained at once by an inspection of the geological map where he was to obtain his materials for the Kingston and Toronto railroad. Mr. Gzowski, in the reports of the St. Lawrence and Atlantic Railroad Company, has publicly thanked the Survey for similar information. The Gaspé *Coal* and Fishing Company suddenly melted into thin air, upon the expression of Mr. Logan's opinion, that *Coal* was not to be found in Gaspé. The question of coal in Canada West was again agitated in the spring of 1854, and "in so serious a manner as might have led to futile but expensive borings in bituminous shale, (at Collingwood), and affected the value of property in its vicinity, had I not fortunately in the beginning of the year communicated to the Canadian Institute at Toronto a paper on the Physical Structure of the Western District of Upper Canada, with a geological map of nearly two-thirds of the Upper Province. These comprehended the whole subject, and the publication of them in August last in the Journal of the Institute has, I should think, settled the question in the minds of all sensible men."

Villagers and isolated settlers have frequently been astonished and delighted at finding themselves actually standing a few feet above that indispensable necessary of life—common limestone. Many instances have occurred to the officers of the Survey of settlers journeying miles for limestone when it lay just beneath their log shanties. An enterprising farmer once said to Mr. Logan, "Now, if you will find limestone near this, I'll give you five dollars." His astonishment was unbounded when Mr. Logan replied, "Why my good friend, you are standing on limestone."

Side by side with what in comparison may be termed the minor instances of the practical results of the Survey, we have most important generalizations, which apply to millions of acres in the Laurentian region of Canada. The rocks of the Laurentian mountains consist largely of lime feldspars, and produce upon disintegration an exceedingly fertile soil. "The vallies underlaid by these rocks have always constituted in my mind the main hope for the Laurentian country in an agricultural point of view; but the discovery of important ranges, largely composed of lime feldspars, greatly extends the prospect of advantage. These rocks have been met with in several localities, from Abercombie to the Sault à-la-Puce in Chateau Richer; and as the Laurentian series in which they occur reaches from Labrador to Lake Huron, they are a subject of real importance to both sections of the Province." The director of the Geological Survey of England has been reminded by Mr. Logan, that if the ancient phosphatic shells were found in any part of the *Lingula* beds in England in the same abundance that calcareous shells are in calcareous rocks, the farmers of England would have to thank Canada for pointing out another source of this mineral manure.

Among the instances of new facts established by the Survey of a scientific character, Mr. Logan enumerated:

1st. The Laurentian series of rocks constitutes a mountainous region from Labrador to the Arctic Ocean. The first fossiliferous rocks on the south side of it belong to the Lower Silurian series. This series, we have shewn, is wanting on the north, the first fossiliferous rocks there met with being of the Upper Silurian age. The inference is that the north side was above water during the Lower Silurian period, while the south was beneath it, and the Laurentian series, for many thousand miles, would thus appear to have been the limit of a Lower Silurian Sea—a great fact in palæozoic geography.

2d. The want of conformity in what I have called the eastern area of Canada, between the Lower and Upper Silurian rocks, and between the Devonian and the Carboniferous, with the fact that the successive disturbances in them all run in lines having parallel directions, has enabled us to shew, that a uniform set of forces producing the undulations have been in operation, from the time of the first traces of organic existence on the face of the globe, until the termination of the Carboniferous era,—a great fact in geological dynamics. A paper on these subjects was read by me before the British Association at Ipswhich in 1851, and it was considered of sufficient importance to obtain the recommendation of the geological committee, that it should be

printed in full in the reports of the Association, the papers in general being printed in abstract only.

3d. We have ascertained that certain fossil and recent shells, instead of carbonate, are composed of phosphate of lime, by which has been broken down a heretofore supposed distinction between the skeletons of vertebrate and invertebrate animals. Professor Agassiz and other naturalists appear to think that very important results will flow from the discovery.

4th. The age of the gold-bearing rocks in North America has heretofore been considered anterior to the fossiliferous, but our investigations from Gaspé to Vermont shew them to belong to the Silurian epoch.

5th. Many mineral species have been analysed and several new ones discovered by Mr. Hunt, and his results have all been adopted by Dana, acknowledged in Europe and America to be one of the first authorities, and by all the various European mineralogists.

Mr. Logan frequently alludes to the discoveries of the accomplished chemist to the Survey, Mr. Hunt, but as we propose soon to advert to the evidence of that gentleman we shall forbear to dwell here upon the results of his valuable and most interesting investigations.

The next witness examined was the Reverend Andrew Bell, of L'Orignal, a gentleman who has devoted much time to the prosecution of geological enquiry in Canada for many years past, and whose opportunities of testing the accuracy of the Survey have been extensive and prolonged. Mr. Bell considers the information contained in the Reports to be "exceedingly accurate," and the amount of information obtained in regard to the country explored "has been very great." "The Survey has already brought to light facts sufficient to show that the mineral wealth of Canada is enormous, affording materials for the useful and profitable application of labour, skill and capital to an almost unbounded extent, and of course all tending towards the future and progressive prosperity of the Province." We are glad to have the opportunity of recording Mr. Bell's testimony that there is a growing taste for geological studies in this country and an appreciation of the advantages to be gained from them.

"Nothing is plainer to me from my own experience, than the fact that there is a gradual breaking down of the prejudices which have been entertained in regard to Geology; and amongst the whole circle of my friends and acquaintances throughout the Province, I have marked a growing desire for information in regard to it, as well as a growing conviction, that there is a definite and orderly arrangement of the rocks, and that it is only in certain rocks that certain useful minerals are to be obtained,—in short that it is science, that points the way. This is especially the case among the young men of the generation fast coming into public life; I see it in the increased love there is for Geological reading generally; I see it in the incipient collections of fossils and minerals, I occasionally meet with through the country, and I see it in the frequent visits I receive for the purpose of seeing and studying my own collection."

The Reverend Mr. Horan, Professor of Geology and Mineralogy in the Seminary of Quebec, expressed the opinion that the Survey has had extremely important results in a scientific point of view, and has proved beneficial in its economic application.

Count de Rottermund of Quebec, examined.—Count de Rottermund differs from Mr. Logan and Mr. Murray in some of the theoretical conclusions at which those gentlemen have arrived; and as to the results of Mr. Hunt's department of the Survey, the Count does not think them worth "any serious attention." It is quite unnecessary to make any further comment upon Count de Rottermund's evidence.

We now proceed to notice as fully as our space will permit Mr. Hunt's replies to the questions put by the Committee. With reference to the important scientific and economic results which have been developed by the Canadian Geological Survey Mr. Hunt enumerates among others the following:—

I may in the first place allude to the investigations of the altered or metamorphic rocks, which are found in Lower Canada on the South side of the St. Lawrence. These rocks are a prolongation of the Green Mountains, and form the north eastern extremity of the Great Appalachian Chain, itself the most important Geographical and Geological feature of Eastern North America. The crystalline rocks, which are economically of great consequence from their mines of iron, chrome, lead, copper and gold, and their beds of fine marbles, serpentines, soapstones, slates, &c., had been regarded by the American Geologists as primary strata, that is to say, more ancient than those oldest secondary rocks, in which are found the first vestiges of organic life. Although some few had ventured the opinion that they were really more recent strata in an altered state, the facts in support of such a novel proposition had not been brought forward, and the opinion of their primary character was still generally received.

It was reserved for Mr. Logan in his researches in the Eastern Townships of Canada in 1847 and 1848, to show that the Geology of that region furnished the key to a correct understanding of the age and Geological structure of the whole Appallachian Chain, and to demonstrate by a most minute and laborious investigation, that these so called primary rocks were really no other than the Silurian strata of the St. Lawrence valley in an altered condition. He has traced the gradual changes by which these fossiliferous sandstones and shales become the gneissoid, micaceous, and chloritic strata of the Green Mountains. In the course of this investigation, the results of the chemical examination of the unaltered strata were brought to bear upon the great question, and we were enable to shew that the chromium, the titanium, and the iron, whose compounds in a crystalline form were regarded as characteristic of some of these altered rocks, exist already in an amorphous condition in the unaltered strata.

As one result of this investigation may also be mentioned the determination of the true nature and origin of the serpentine of this formation. Serpentine is a magnesian mineral, which the highest authorities in the science have hitherto regarded as in all cases of igneous origin, and an intrusive rock like trap or granite. We have shown that in the Appallachian Chain, it is really a stratified rock of aqueous origin, and have actually assigned its true place in the Silurian strata. Our researches have moreover shown that the magnesia, which enters into the composition of the serpentine and its associated dolomites and talcose slates, was not introduced subsequently to the decomposition of the rocks, as is supposed in the theory of von Buch, hitherto generally adopted, but that it formed a part of the original sedimentary deposit. This conclusion I regard as an important step towards a more simple and rational theory of mineral metamorphism, than the one hitherto received.

The establishment of the metamorphic nature and the true age of the crystalline rocks of Eastern North America, from the Gulf of the St. Lawrence to the Gulf of Mexico, is the more important from the grand exemplification which it affords of the metamorphic theory. Hitherto, although the existence of such changes was considered probable, the cases in which the fact of alteration had been proved were but few, and confined to limited areas. Portions of the Alps of Savoy and Switzerland, and the marbles of Carrara in Italy, had been shown to be altered secondary strata, but most Geologists have hitherto been unwilling to accept the bold generalizations of Lyell, and extend a similar view to wide spread areas. The results of our Survey, which have shown the truth of this view as applied to a great portion of the Western Continent, have now placed the theory on an assured basis.

Another interesting investigation has been that of the Laurentides. This mountainous region, stretching from the Gulf west to Lake Huron, is composed of the oldest known rocks, not only of North America, but of the globe. On this continent, they are so far as yet known confined to British America, except a prolongation into northern New York, and perhaps some exposures west of the Mississippi, while in the old world they have been recognized only in Scandinavia, Finland and northern Russia, and perhaps in the north of Scotland. These rocks have never hitherto been carefully investigated, and a partial examination in the state of New York, had led an American Geologist to regard them as of igneous origin, and to look upon the crystalline limestones and hypersthene rocks, with their associated iron ores, as alike intrusive. The researches of our Survey have shown that these antique portions of the earth's crust are, not less than the rocks of the Eastern Townships, metamorphic sedimentary deposits, and indicate the existence at the remote epoch of their formation, of Physical and Chemical conditions similar to those, which have accompanied all the succeeding Geological periods.

Mineralogically, the investigation of the so-called hypersthene rocks

of this formation, with their peculiar calcareous triclinic feldspars, is of eminent scientific interest, while the fact, that the famous iron mines of Sweden, Russia, and those of Lake Champlain in the United States, belong to this series of rocks, gives them a great economic importance. The immense deposits of iron ore at Marmora, Madoc, South Sherbrooke, South Crosby, McNab, Hall, and elsewhere in the same region are contained in this formation. It is interesting as illustrating the connection between the geology and the agricultural capabilities of a district, to observe that wherever in the region of these Laurentian rocks the calcareous feldspars, above alluded to, are met with, their decay gives a fertile soil, strongly contrasting with the barrenness of those districts, where the more silicious portion of the formation prevail.

In speaking of the economic results of the Survey, the examinations of our mineral waters must not be forgotten. From their medicinal value mineral springs often become centres of attraction and of population; Bath and Harrowgate in England, the famous watering places of Germany, and those of Virginia and Saratoga in the United States among others, owe their importance to mineral springs. Canada abounds in mineral waters of almost every kind, and their investigation has occupied much of my time during several years. The Annual Report of Progress of the Geological Survey for 1853, contains a list of fifty-six springs, with references to the pages of that, and of previous reports, in which the analysis may be found. The number of mineral waters, whose composition is thus made known, is greater than that of all the others yet described in America, and the published results will show that, probably nowhere but in France and Germany, have the examinations been made with the same degree of minuteness as in Canada. A great proportion of the waters have been analyzed quantitatively.

Among the most remarkable of our mineral springs thus made known, are those which contain large portions of iodine and bromine salts, and others holding in solution salts of the rare bases baryta and strontia, which had hitherto been detected only in a few springs in Germany. We may also mention the numerous alkaline waters, remarkable for the great proportion of carbonate of soda which they contain, along with silicate, phosphate and borate of soda, or borax. This rare salt hitherto unknown in the waters of North America has been found in several springs in Lower Canada. The waters of Tuscarora, Chippawa, and St. David's in Upper Canada, remarkable for containing large quantities of free sulphuric acid, with sulphuretted hydrogen and sulphates of alumina, iron, and lime, may also be mentioned, and the sulphur spring of Charlotteville, near Simcoe, C. W., surpassing in the amount of sulphuretted hydrogen the famous Harrowgate waters, is also worthy of especial notice, for it is destined at some future time to become an important watering-place. The results of these analyses have made known to the medical profession the Chemical composition of all these various waters, and will enable the enlightened physician to prescribe them with discrimination in the various forms of disease.

The study of these different springs has at the same time been made with especial reference of their geological position, and many curious and important relations between their soluble mineral contents, and the composition of the sedimentary rocks, have been shown, throwing light at the same time upon the theory of the formation of mineral waters, and the chemistry of the strata through which they flow,"

It was one of the objects of the Committee to ascertain how far the Geological Survey of Canada had been appreciated by distinguished scientific men abroad; and here we may incidentally remark, that no one who peruses the evidence of which we have given an abstract, can fail to notice the kindly feeling which appears to exist among the officers of the Survey, and especially between those whose position and labours have at this juncture been most prominently brought before the public. Mr. Hunt, with much taste, makes the following quotation from a well known and able pen in the *London Quarterly Review* for October, 1854, which is the only one, out of many, which we have room to insert. "In Canada, especially, there has been proceeding for some years one of the most extensive and important Geological Surveys now going on in the world. The enthusiasm and disinterestedness of a thoroughly qualified and judicious observer, Mr. Logan, whose name will ever stand high in the roll of the votaries of his favourite science, have conferred upon this great work a wide spread fame." Mr. Logan tells the Committee that he (Mr. Logan) is "by profession a Miner and a Metallurgist," and almost in the same breath, while not forgetting to enumerate the well deserved encomiums of distinguished scientific men abroad upon the general results of the Survey, points to Mr. Hunt's valuable contributions to the *London Philosophical Magazine*, as well as other scientific publications, and to the *American Journal of Science;* to his analysis of mineral species and his various results with regard to them—adopted by Dana,—to the works of Gerhardt and Laurent by whom he is quoted, and to his communications to the American Association.

Coleoptera Collected in Canada.*

By William Couper, Toronto.

For Authorities and synonyms see Melsheimer's Catalogue, &c.

LEBIA

? vittata Fabr.—*Mels. Cat.* Antennæ black, about twice the length of thorax; head red: eyes black; thorax red, orbicular: margin very narrow; elytra black, with a bright yellow longitudinal stripe on the centre of each, and another on the margin; truncate behind; body beneath and thighs red; tibiæ and tarsi black. Length 2 lines.

This little rarity was taken about one mile north of Toronto in the summer of 1848; since then I have not seen another. It is evidently a variety.

SCARITES

subterraneus.—*Mels. Cat.* Antennæ reddish, 11-articulate, the two basal joints longest; jaws curved, nearly the length of head, grooved on top, each armed with an inside lance-like tooth near the base; head grooved on both sides; thorax smooth, polished, with a slight transverse protuberance on front, and a fine longitudinal groove on the disc; elytra with eight smooth striæ, and three slightly impressed punctures on each—one on front and two behind; fore-legs palmate; shanks toothed; body and legs with a few hairs. Toronto peninsula, May, not common. Length 7 lines.

AMARA

vulgaris Lin.—*Mels. Cat.* Antennæ dark brown, villous; head and thorax black, polished; elytra black, highly polished, and slightly tinged with copper-coloured bronze; body beneath and legs black. Toronto, common. Length 5 lines.

AGONDERUS

? lineola Fabr.—*Mels. Cat.* Antennæ light brown, and very short; head reddish-yellow, with a black transverse fascia on top; thorax reddish yellow, on which there are two black spots; elytra yellow, striate, with two longitudinal black lines on each side of suture; body beneath and legs pale. Toronto peninsula, very rare. Length 3½ lines.

Evidently an allied species.

NECRODES

surinamensis.—*Mels. Cat.* Antennæ clavate, perfoliate; head and thorax black, the latter orbicular and polished; scutellum triangular, finely punctured; elytra black, minutely punctured, with three longitudinal raised lines on each, and slightly depressed behind: each with a yellow transverse notched fascia, which in some specimens appear in the form of three dots; hind thighs toothed. Toronto and Manitoulin, common. Vary in length from ½ to nearly 1 inch.

THANATOPHILUS

caudatus.—*Mels. Cat.; tuberculata* Germ. Antennæ clavate, perfoliate: head and thorax densely covered with short

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* Continued from page 212.

yellowish hairs; elytra dark grey, and, on each, four rows of tubercles longitudinally arranged; obtuse at the apex. Toronto, common. Length 5 lines.

Taken by Richardson at Fort Simpson, lat. 62° N.

PÆDERUS

RIPARIUS.—*Mels. Cat.* Head, elytra, and tip of abdomen steel-blue; thorax and anterior part of abdomen bright orange. Toronto, common. Length 2 lines.

DINEUTES—CYCLINUS

AMERICANUS Lin.—*Mels. Cat.* Black. Apex of each elytron armed with a short tooth; mouth with setæ; a row of very short hairs on the anterior femoræ; four posterior legs short, thin, and transparent. Toronto, not common. Length 5 lines.

BYRRHUS

VARIUS.—*Mels. Cat.; trivittatus*, Melr. Head and thorax tinged with dark copper bronze; elytra dark brown, finely striate, on which are three longitudinal green lines, interrupted by small black spots. Toronto, very common. Length 2½ lines.

HISTER

ABBREVIATUS.—*Mels. Cat.* Black. Jaws as long as head; thorax smooth, each side with a fine marginal groove; elytra abbreviated behind; striate—the striæ abbreviated towards the suture; outside of tibiæ toothed. Owen Sound, common. Length 4 lines

CANTHON—COPROBIUS

LÆVIS.—*Mels. Cat.* Entirely black, shining like pitch. Clypeus broad, flattish, smooth, and surrounding the eyes, slightly 2-toothed in front; thorax finely margined, smooth, and convex; scutellum obsolete; elytra margined, not reach-the anus, with longitudinal grooves, not quite visible to the naked eye; anterior tibiæ with three large teeth on the outside, above which are several smaller ones; posterior legs long and thin. Toronto, not common. Length 8½ lines.

COPRIS

CAROLINA.—*Mels. Cat.* Deep black, and shining like pitch, both on the upper and under sides. Clypeus round in front, thin, and armed with a round black horn bending backwards; thorax margined, lying very high above the head, having four protuberances in front, and a small impression each side near the margin; elytra with crenate furrows, and reaching the anus. Thighs strong, not hairy; anterior tibiæ armed with four teeth, and a strong spur on each; tarsi and ungues small. L. 7 lines.

♀ size and color of ♂, but the protuberances on thorax are not so large. Toronto, not common.

ONTHOPHAGUS

HECATE.—*Mels. Cat.* Black. Antennæ short, lamellate; clypeus polished, with an erect thin dent in front; thorax elongated, projecting over the clypeus, slightly furrowed and armed with two short dents at the point; elytra abbreviated by suture—longest from shoulder to apex; fore legs 4-toothed on the outside; body beneath and legs covered with short hairs. Length 3½ lines.

♀ black. Two transverse ridges on clypeus; thorax densely and minutely punctured, and covered with short hairs; two protuberances in front; elytra finely punctured in rows; fore legs toothed. Size of ♂. Toronto, common.

APHODIUS

FIMETARIUS.—*Mels. Cat.* Head black, with three small tubercles on top; thorax black, slightly hollowed in front, with a red spot each side; elytra red, striate; body beneath and legs black. Toronto, common. Length 3 lines.

STERCORATOR.—*Mels. Cat.* Black. Head and thorax polished, the latter emarginate; elytra striate. Toronto, common. Length 2 lines.

PASSALUS

CORNUTUS.—*Mels. Cat.; interruptus*, Oliv. Antennæ arched, covered with short reddish hairs; jaws as long as head, 5-toothed; head has a protuberance each side above the eyes, and a recumbent horn on the crown; thorax black, polished, longitudinally grooved on the disc—fringed with reddish hair under the margin; elytra highly polished, with ten striæ—the striæ punctured; fore tibiæ toothed on the outside; tibiæ of the middle pair with a dense brush of red hair on the outside. Niagara. Mr. Ibbetson. Length 1 inch.

XYLORYCTES

SATYRUS.—*Mels. Cat.* ♂. Clypeus narrow, of a dark chestnut colour, armed with a strong sharp-pointed horn bending backwards, and furnished in front with two small protuberances; hairy beneath; thorax dark chestnut, margined, and finely punctured in front—the upper part elevated, and appearing almost perpendicular; elytra reddish-brown, with many slight punctured furrows, which are longitudinally arranged; thigh reddish-brown, broad, strong, and hairy; anterior tibiæ deeply dentate, with a strong spine at the tips; middle tibiæ strong, hairy, and very spinose at the tips; ungues very small; scutellum triangular. Length 1 inch.

♀ size and colour of ♂, but without the horn. In place of the latter there is a short protuberance; thorax smooth and convex. Toronto, very rare.

PHYLLOPHAGA

HIRTICULA ?—*Mels. Cat.* Bright chestnut. Thorax punctured, and covered with yellow hairs; elytra smooth, punctured, with five longitudinal rows of yellow hairs on each—the fifth on the suture; breast covered with yellow down. Toronto. Length 5 lines.

Probably a variety.

TRICHIUS

PIGER.—*Mels. Cat.; rotundicollis*, Kirby. Head and thorax black, the latter rotund and covered with whitish down; elytra truncate behind, black, polished on the outside, yellow-ochre in the centre, with four longitudinal lines of the latter colour pointing like teeth towards the apex; on each elytron, two oblique white stripes branch from the yellow-ochre to margin; a white tuft on each side of abdomen; body beneath and legs hairy. Toronto, common. Length 5 lines.

BUPRESTIS

AURULENTA, Lin. (*Mels. Cat.*); *striata*, Fabr. Antennæ short, black, the basal joints coppery; head and thorax dull coppery, finely punctured. On each elytron there are four raised lines: the outside or marginal line connects at the apex with a longitudinal one near the suture; the two inner lines abbreviated, their furrows tinged with a beautiful green colour; body beneath and legs of a rich metallic lustre. Toronto, on pines, not common. Length 7 lines.

TRACHYPTERIS

FULVOGUTTATA.—*Mels. Cat.; Drummondi*, Kirby. Short, and mostly convex; black bronze above, with very fine wavy transverse lines on thorax, which are not very distinct without the aid of a magnifier; elytra rounded at the apex, and punctured; three yellow spots on each—the anterior spots round and near the suture, the central one almost oval. Specimens vary in size, and some are found with two anterior spots (*punctum geminum*) on each elytron; body beneath brassy; anterior legs not toothed. Toronto, June, on white pine.

Taken by Richardson at Fort Simpson, on the Mackenzie river, lat. 62° N. Length 4 lines.

CRATONYCHUS

CINEREUS.—*Mels. Cat.* Dark-brown, covered with ash-coloured hairs. Thorax convex, rounded in front, and finely punctured; elytra with longitudinal rows of punctures resembling stitches, tapering towards the apex; tarsi armed with minute teeth. Toronto, common. Length 6 lines.

PODABRUS

TRICOSTATA.—*Mels. Cat.; Teleophorus Bennetii*, Kirby. Antennæ black, serrate; thorax margined with black and pink, round in front, convex in the centre, and angular behind; elytra dark glossy brown. Common in winter, under the bark of trees. Length 5 lines.

TOMICUS—BOSTRICHUS

CALLIGRAPHUS.—*Mels. Cat.*; *exesus*, Say. Chestnut brown. Thorax oval, and punctured in front; elytra punctured in rows, with a gouge-like hollow at the apex, the sides of which are armed with minute teeth. Toronto, found under the bark of pine trees. Length 2 lines.

PINI.—*Mels. Cat.* Resembles *exesus* in form, colour, and habits, but is much smaller.

SPHENOPHORUS

PERTINAX.—*Mels. Cat.* Antennæ two-articulate, polished, and longer than snout, the first joint dark mahogany colour, the second darker and knobbed at the point; head and snout black, polished, the latter curved, and of an equal thickness throughout; thorax with three black polished ridges, the spaces between of an ashen colour; elytra with abbreviated black, polished, longitudinal ridges, the longest on the suture, and finely punctured at the sides—the spaces between of a dark ashen colour, and finely striate; margin black, polished, with a row of punctures: abbreviated behind; abdomen hirsute; body beneath black, punctured; legs black. Length 5 lines. Toronto, common.

ATTELABUS

BIPUSTULATUS.—*Mels. Cat.* Head bent under the breast; thorax steel-blue and highly polished, narrow in front; elytra with a square reddish-ochre spot on each shoulder; body beneath and legs blue. Toronto, not common. Len. 1½ lines.

CALLIDIUM

ANTENNATUM.—*Mels. Cat.* Head and thorax steel-blue, the latter emarginate; elytra green, polished, and densely punctured, nearly equal in width throughout; body beneath and legs black, polished. Manitoulin. Mr. Ibbetson. L. 4½ lin.

RHAGIUM

LINEATUM.—*Mels. Cat.* Antennæ ash-coloured, about as long as head and thorax; head depressed on top, ash-coloured, and spotted with black; eyes of a polished dark chestnut color; thorax ash-coloured, wider than head, with a polished longitudinal line in the centre, and a short sharp-pointed tubercle on each side; elytra ash-coloured: on each there are three longitudinal raised lines obliquely spotted with black—the spaces between hirsute; body beneath and legs ash-coloured, variegated with black. Length 6½ lines. Rare. One specimen, Dr. Cowdry, Cobourg.

EVODINUS

MONTICOLA.—*Mels. Cat.;* Le Conte, Agass. Lac. Sup. t. 8, fig. 2. Antennæ reddish; eyes and ring behind the head black; thorax narrow before and behind, and covered on top with yellow silky hairs; elytra yellow, tapering towards the apex, with two small round black spots behind each shoulder, and two larger black spots on the posterior margin; black at the apex; abdomen and legs red. Toronto, Prof. Croft. Length 4 lines.

STRANGALIA

ZEBRATA.—*Mels. Cat.; zebra,* Oliv. Ent. Eyes black; top of head and thorax sprinkled with fine yellow down; elytra black, on which are four oblique bright yellow fasciæ—the first transverse from the shoulders, encircling a black spot on the latter—the second and third are almost equal in form, crosses from margin towards suture—the fourth much smaller, and near the apex; legs reddish; body beneath covered with yellow down. Toronto, on flowers, very rare. Length 5 lines.

FUGAX.—*Mels. Cat.; Leptura tenuior,* Kirby. Antennæ and head black; thorax black, round on top, and covered with yellow silken hairs; elytra dull red, towering behind, on which are four transverse yellow bands, covered with short hairs, having the glossy appearance of thorax; legs and rings of abdomen reddish. Toronto, on flowers, not common. Length 5 lines.

LEPTURA

CANADENSIS.—*Mels. Cat.;* ♂ *tenuicornis* Hald. Antennæ black, ten-articulate: the fifth, seventh, and base of the ninth yellow; head black; thorax globular, black, punctured, narrow in front, on which there is a fine ring; elytra densely punctured, with a broad red transverse band on the shoulders—armed with a small spur at the apex; body beneath and legs blackish. Toronto and Manitoulin, on umbelliferous flowers, not common. Length ♂ 5, ♀ 7 lines.

BIFORIS.—*Mels. Cat.* Antennæ ten-articulate, part of the first joint yellow; second, third, and fourth black: the remaining five are yellow, ringed with black, and the last yellow; head yellow, black on top; eyes black; thorax reddish-yellow, with a longitudinal oval black spot on the centre, connecting with the region of scutel, which is also black; elytra glossy yellow or ashen, with a black spot on the margin behind each shoulder. In the centre, a black tooth-like spot points from margin to suture, and from the latter spot the margin is black to apex; suture finely margined with black; apex two-toothed; legs yellowish—femoræ of fore legs spotted with black: tibiæ, tarsi, and the lower section of femoræ of hind legs black. Toronto, on the *Sambucus Canadensis*, not common. Length 6 lines.

TRIGONARTHRIS

PROXIMA.—*Mels. Cat.;* (Leptura) Say, T. Acad. 3, 420. Antennæ, head, and eyes black; thorax globular, and covered with short rust-coloured hairs; elytra yellow-ochre, black at the apex; body beneath and legs black. Toronto, on flowers, not common. Length 6 lines.

LEMA

TRILINEATA.—*Mels. Cat.* Antennæ black, the first joint reddish; head and thorax rusty-red, the latter swelled out above the femoral joints of fore legs, with two small black spots on top; eyes black; elytra finely punctured, of a nankin colour, with a black line on the outside of each, and the suture black, which forms the three lines; outside of tibiæ and tarsi dusky; body beneath reddish. Makes a creaking sound when held in the fingers. Toronto, not common. Length 3½ lines.

UROPLATA

ROSEA.—*Mels. Cat.* Antennæ black at the base, thickened and red at the tips; head red, narrow, and punctured; thorax conical, punctured, on which are two short longitudinal black lines on top: black at the sides; elytra of a reddish colour; shoulders pointed: square behind, with three elevated smooth longitudinal lines on each, spotted with black and red: the spaces between punctured in double rows; body beneath black; legs reddish. Length 2 lines. Toronto, June, on various plants; not common.

DISONYCHA

CAROLINIANA.—*Mels. Cat.* Antennæ black; eyes dark grey; thorax yellow, with two distinct black dots on the centre;

elytra yellow, on which are five longitudinal black lines, viz., one from the inside of each shoulder, abbreviated near the apex, another on the outside, joins at the apex to the fifth line, which covers the suture—margin yellow; femoræ glossy red; tibiæ and tarsi black. Toronto, not common. Length 3½ lines.

LABIDOMERA

TRIMACULATA.—*Mels. Cat.* (Doryphora) Say, I. Acad. 3, 454. Antennæ, head, thorax, scutellum, body beneath, and legs blue; elytra finely punctured, orange, on which are 3 large black spots of the following forms: the first, on the shoulder, is broad and longitudinal; the second is transverse on the suture—its centre almost connects with the scutellum, and spreads into four obtuse branches: the two anterior point towards and slightly connect with the shoulder spots: the posterior branches are rather shorter; the third spot is near the apex, of a triangular form; margin of elytra, orange. Length 4½ lines. Toronto and Coldwater, on the milk plant (*Asclepias Syriaca*). July.

CALLIGRAPHA

SCALARIS.—*Mels. Cat.* Antennæ rust-red; head and thorax dark green; elytra silvery, with a large green spot on each shoulder, and a number of smaller spots on the sides: a broad jagged green stripe down the suture; under side of body dark green; legs rust-red. In May on various plants. Of this beetle there are two broods during summer. About the latter part of July the first disappear, and at this time numbers may be found dead in the lake drift on the peninsula. Mr. Harris says they pass the winter in holes, and under leaves and stones. L. 4 lin.

GASTROPHYSA

CÆRULEIPENNIS.—*Mels. Cat. polygoni* Lin. Antennæ blackish; head, elytra, and body beneath dark blue; thorax and legs dull orange red; plantæ black.

Immediately before the ♀ deposits its *ova*, the abdomen swells beyond the elytra. Length 1¾ lines. Toronto, common throughout summer on the knot grass.

CHRYSOCHUS

AURATUS.—*Mels. Cat.* (Eumolpus) Harris. Antennæ black; head and thorax polished green, the latter rotund in front; elytra rich golden green, polished, wider in front than thorax, with a very narrow margin; scutellum, body beneath, and legs polished green; tarsi black. Oblong-oval in form, generally about 4 lines in length. Sault Ste. Marie and Toronto, in July and August, on the Dog's-bane (*Apocynum Androsæmifolium*). Not common.

CRYPTOCEPHALUS

SELLATUS.—*Mels. Cat.* Antennæ long, reddish at the base, and black at the point; thorax black, highly polished; scutellum black, tuberculate; elytra densely and minutely punctured in rows, with an orange-red spot behind each shoulder, and another on each side of apex. Length 2 lines. Toronto, common.

Kirby describes the above as *C. notatus* F., which Mr. Haldeman states is a southern species.

HIPPODAMIA

PARENTHESIS (?)—*Mels. Cat.; tridens* Kirby. Thorax black, the margin in front yellow; elytra yellow, on which are three black transverse fasciæ, viz., the first on front, crosses the suture: that on the centre abbreviated nearly equal in breadth throughout: and the posterior one oblique, wider towards the suture; body beneath black. Toronto, not common.

13-PUNCTATA Lin. (*Mels Cat.*) Cocc. *tibialis* Say. Oblong. Thorax black: the margin yellow, and on each side a small dot; elytra yellow; six black dots on each—the thirteenth occupy the place of scutellum. Toronto, common.

Taken by Richardson at Great Bear Lake, lat. 65°—67° N.

COCCINELLA

SANGUINEA.—*Mels. Cat.; immaculata* Fabr. Thorax black, polished, with a bright yellow margin, which partly encircle a black spot on each side; elytra reddish-orange colour, immaculate. Small, convex. Toronto, not common.

BIPUNCTATA.—*Mels. Cat.; bioculata* Say. Thorax black, polished, with a yellow marginal spot each side; elytra reddish colour, with a single black polished spot on each.

In winter, numbers of this species are commonly found congregated together under the bark of trees.

NONEMNOTATA.—*Mels. Cat.* Thorax black, with a white angular spot on each side in front, connected behind the head by a white transverse line; elytra dull orange, with nine black dots—two anterior, small: two posterior, large: the ninth is behind the scutellum; body beneath and legs black. Toronto, common.

UPIS

CERAMBOIDES Lin. (*Mels. Cat.*); *reticulatus* Say. Black. Antennæ eleven-jointed, gradually widened from the base; thorax emarginate, minutely punctured; elytra black, broader than thorax, very hirsute, with zigzag polished protuberances; legs long and slender: fore tarsi five-jointed: hind tarsi four-jointed.

Taken by Mr. Ibbetson at Manitoulin, and by Mr. Richardson, on the borders of the Mackenzie and Slave rivers, lat. 62° N.

BOLITOPHAGUS—ELEDONA

CORNUTUS.—*Mels. Cat.* Antennæ composed of short articulations, thicker at the point; shield hirsute, armed in front with two short teeth; thorax hirsute: seven short teeth on each side, and from the centre of which project two horns over the shield, with a dense brush of reddish hairs underneath; elytra hirsute, with three rows of tubercles on each. Entirely of a dull rust color. Found in fungi. Common. L. 5 lines.

♀ has two protuberances on thorax; elytra hirsute. Size and colour of ♂.

NOTOXUS

MONODON (?)—*Mels. Cat.* Antennæ filiform; head bent down, of a dark brown colour; thorax projecting like a horn over the head; elytra yellow, villous, with a black line down the suture, which spreads apart behind, and terminates in a round dot on each: an oblong black spot on the sides. Toronto, common on umbelliferous flowers. Length 1½ lines.

(*To be continued.*)

Water-Works in the United States.

By Jacob Houghton, C.E.

Cincinnati.—The city of Cincinnati is supplied with water from the Ohio river, from which it is elevated, by means of steam-engines, to a height of 175 feet, into a stone reservoir, containing 5,000,000 gallons. There are three engines, one condensing, and two non-condensing. The pumping or rising mains are 800 feet in length. These works were originally owned by a company, from whom the city purchased them for $300,000. To April, 1853, they had expended $700,000 in improvements, making a total cost of $1,000,000. Further extensive improvements are in contemplation. Nine years ago these works were in a very bad condition, the water being distributed principally through wooden logs, which have been entirely replaced with iron pipes. Cincinnati contains upwards of 160,000 inhabitants.

Pittsburgh is supplied with water from the Alleghany river.

At this place there are two reservoirs, at different elevations, the lower one at 160 feet, and the upper one at 396 feet above low-water mark. The water is elevated into the lower reservoir from the river, by means of two large high-pressure engines, through a distance of 2000 feet. At the lower reservoir are two smaller engines, driving pumps which elevate the water into the upper reservoir through a pipe about one-fourth of a mile in length. This pumping pipe is also used as a distributing main, being connected with the distributing pipes; and while the engines are running, the entire service connected with the upper reservoir is supplied directly from the pumps. This mode of using the pump main, for the double purpose of an inlet and outlet, has proved an unfavourable experiment. All means of circulation are prevented, and the water, becoming stagnant, has a bad taste and odour, and gives rise to a great deal of complaint. The reservoirs are built of earth embankments, the inside slopes paved with brick. These works have cost about $700,000, and supply 50,000 inhabitants with water.

Alleghany City.—The population of this city in 1850 was 22,000. Cost of works, to January 1st, 1853, $331,442·12. The water is obtained from the Alleghany river, by means of two steam-engines, which are duplicates from the same patterns as those at the upper works in Pittsburg. The water is raised to a height of 206 feet, through a pump main about 1000 feet in length. The reservoir is of earth embankment, and will hold 10,000,000 gallons.

Buffalo.—The waterworks of this city are owned by a company. The water is taken from the Niagara river, and is carried into the pump well, through a tunnel cut through the rock, under the Erie Canal. The water is raised to the reservoir, by means of two Cornish Bull-engines, cylinder 50 inches diameter, and 10 feet stroke. The reservoir is of earth embankment, and will store 13,000,000 gallons. These works have cost upwards of $400,000. Population of the city about 60,000.

Albany.—The city of Albany is supplied with water from Patroon's Creek, across which, about six miles from the Hudson river, an embankment of earth, 40 feet in height, has been built; thus forming a retentive reservoir, called Rensselaer lake, covering an area of 30 acres, and containing about 160,000,000 gallons of water. From thence the water is conducted by gravitation through a brick aqueduct about 4 miles in length, to Bleecker reservoir, from whence it is distributed in the usual manner. A further supply is delivered to the lower part of the city, through iron pipes, laid directly from Watervliet lake. This artificial lake is on the same stream with, and about four miles below Rensselaer lake, and was formed by constructing a dam, 25 feet in height, across the stream. It overflows about 20 acres, and contains 30,000,000 gallons. These works are capable of delivering 10,000,000 gallons daily, and have cost about $800,000. Population of the city about 60,000.

New York is supplied with water from the Croton river, across which a dam, 40 feet in height, is constructed, forming the Croton lake, covering an area of 400 acres, and containing, at the depth of 6 feet, an available supply of 500,000,000 gallons of water. From thence the water is carried, by means of a brick aqueduct (except at the crossings of the Haarlem river bridge, and the Manhattan Valley, where inverted syphons of the respective dips of 12 feet and 105 feet are used), about 38 miles in length, and having a total fall of 44 feet, to the receiving reservoir, which covers 37 acres of ground, and has capacity of 150,000,000 gallons. From this reservoir the water is conducted through iron pipes to the distributing reservoir, from whence it is distributed in the usual manner. This reservoir is built of stone, covers an area of four acres, and contains 21,000,000 gallons, when full to the top water line. These works are capable of supplying 30,000,000 gallons per day, have cost between $13,000,000 and $14,000,000, and supply water to more than half-a-million of people. An enlargement of the works is now in contemplation, by which the quantity of water delivered daily will be materially increased.

Philadelphia—Fairmount Waterworks.—At the Fairmount waterworks the water is raised from the Schuylkill river, by means of water power. A dam, 1149 feet in length, and 13½ feet in height, above low tide, is constructed. From this dam water is supplied to run eight breast-wheels, and one "Jonval turbine," each driving a double-acting force-pump. The water is forced to a height of 96 feet, through mains of 16 inches diameter, varying in length from 183 to 433 feet. On the hill at Fairmount are four reservoirs, containing, in the aggregate, 22,031,976 ale gallons, and at a distance of three-fourths of a mile is a fifth reservoir, containing 16,646,247 ale gallons, making the total storage of the Fairmount works equivalent to 38,678,223 ale gallons. During the year 1852 the average quantity of water pumped daily was 5,731,744 gallons, which was distributed in a district containing 26,821 houses, in which there were 27,592 ratepayers. The cost of these works to January 1st, 1853, was $3,247,894. These works were the first of any importance erected in the United States, and have served as a model for almost every city in the country.

Spring Garden Waterworks.—The districts of Spring Garden and Northern Liberties are supplied with water from separate works, erected upon the Schuylkill, about a mile above Fairmount. Three condensing engines are in use, which force the water to a height of 115 feet, into an earth embankment reservoir. There are three pump mains, two of 18 inches and one of 20 inches diameter, and 3300 feet in length. The district of Kensington is also supplied by independent steam-power works, situated upon the Delaware river. These works, however, I did not examine.

Boston is supplied with water from Lake Cochituate, formerly called Long Pond, from which it is conducted by means of a brick aqueduct (except at the crossing of the Charles river, where there is an inverted syphon of 58 feet dip), 15 miles in length, with a fall of 4¼ feet, to the Brooklyn reservoir. This reservoir covers an area of 22⅓ acres, and has a capacity of 89,909,730 wine gallons. From the Brooklyn reservoir the water is conducted through iron pipes to three distributing reservoirs, as follows: one on Beacon Hill, in Boston Proper, capacity 2,678,968 gallons; the second on Telegraph Hill, in South Boston, capacity 7,508,246 gallons; and the third on Eagle Hill, in East Boston, capacity 5,691,816 gallons. From these reservoirs the water is distributed by means of iron pipes. The basin containing the water on Beacon Hill is 15 ft. 8 in. deep, supported on arches, the whole being a massive structure of granite, the walls of which, on Derne Street, are 58¾ feet high, and in the rear of Mount Vernon Street, 40 ft. 8 in. high. The other reservoirs are of the earth embankment kind. The water is carried across the channel of Chelsea Creek to East Boston, in a 20-inch flexible pipe, with swivel joints, and of nearly double the ordinary thickness. During the year 1852, these works delivered 8,125,842 wine gallons per day, to a population of about 140,000. To January 1st, 1853, the works had cost $5,370,818.

Chicago.—The city of Chicago, for the last two years, has been engaged in constructing water works, which are now so far advanced, that they will be brought into use within a short time. An inlet pipe, made of pine staves, 30 inches diameter,

is extended into Lake Michigan, a distance of 600 feet, through which water is supplied to the pump well, from which it is elevated, by means of two steam engines (a condensing and a duplicate non-condensing), into a reservoir at a height of 8 feet. For the want of elevated ground, they are compelled to make use of a tower and tank similar to the one in use at Detroit. The tank is made of boiler iron, braced across its centre with wrought-iron rods, is 60 feet diameter, 28 feet deep, and contains about 493,000 gallons. Other reservoirs of like capacity, will be constructed as required. The works are calculated to furnish a daily supply of 3,000,000 gallons, and have cost about $400,000. The unprecedented growth of that city will probably require the immediate extension and enlargement of the works.

The Hurricane of the 18th April, 1855.

The interest excited by the brief and unconnected accounts which have been published from time to time, of the course and effects of the Hurricane of the 18th April, affords sufficient grounds for noticing at length an occurrence which, though not unfrequent in Canada, is still possessed of general and wide-spread interest. It happens very unfortunately in the present instance, that few memoranda of the time when the storm of wind and hail was at its height in different localities appear to have been preserved. The extracts from newspapers to which we have been able to refer, make specific mention of the time of the occurrence in three instances only. It is therefore quite impossible, from the data before us, to trace with accuracy the course of the storm, or to ascertain the width of the moving mass of air in different places. We may, however, obtain some idea of the diameter of the circle described by the storm in its course. Occasionally we find trees, fences, and houses exhibiting its effects over areas many miles in width, while in other places it appears to have struck the earth with extraordinary violence over a narrow belt not more than a few hundred yards broad. The fluctuations in the levels of Lakes Huron and Ontario, and Seneca Lake are evidently nothing more than "Seiches" due to sudden variations in atmospheric pressure, a necessary result of the rapid passage of an immense vertical column of air over the surface of their waters.

It is a rather singular coincidence, that on the 25th of April, 1854, a storm somewhat similar in its effects to the hurricane of the 18th April, 1855, should have traversed nearly the same ground. Two persons were then drowned at Niagara by the sudden rise of the waters of the Lakes. At page 278 of the *Canadian Journal*, Vol. II., an account of this storm may be found, and the following extract from the *Niagara Mail* of May 3rd, 1854, giving a description of the rise in the Lake, may not inappropriately be introduced here :

"About a quarter or half-past six o'clock, p. m., a thunder storm came up from the north-west, with a few flashes of lightning and a heavy shower, accompanied by a strong squall of wind for a few minutes, the weather being quite calm just before the gust, and the same after it. The fishermen who were on the beach, seeing the squall coming on, hurried to get in their lines, when suddenly there appeared rolling in upon them an immense wave from the north-west. The height of this wave could not have been less, we judge, than from six to eight feet, although it is difficult to ascertain correctly. It came rolling on the smooth Lake with great velocity, carrying all before it, and sweeping some of the fishermen into the Two Mile Pond, and dashing others of them high up against the bank, by which, as we stated, two persons were unfortunately drowned. The water came and returned three times in succession, and then settled down quite calm as it had been before this commotion."

The late storm appears to have crossed the Indian Reserve Peninsula from Lake Huron, and passing over Georgian Bay it struck the main land of Canada in the township of St. Vincent, near the village of Meaford.

At Meaford the storm commenced about 4 a. m. "The wind blew a perfect hurricane." "Hailstones of very great size fell in a continued shower for fifteen or twenty minutes." At Owen Sound, a few miles west of Meaford, the storm of wind does not appear to have been noticed. The *Owen Sound Comet* describes the rising and falling of the waters of the Bay on the 18th, and attributes the phenomenon to a storm "of which we may hear in a few days." The following extract is from the *Owen Sound Comet*:

"PHENOMENON.—Last Wednesday a very singular occurrence happened in Owen Sound Bay, such as has frequently been witnessed on former occasions, but not in so great a degree. This last freak commenced by the rising of the water to the height of say nine feet, and immediately falling down say ten feet. The bottom of the Bay was dry when the water went down to within ten or fifteen feet of the end of the wharf, and we are told by Mr. John Boyd, that a man might have waded across to the Indian Village at the time. We are also told by those who were present at the time, that at the bridge crossing on Division Street, a man might have jumped across the river. The rising and falling followed in quick succession, and so suddenly, that an observer could distinctly see the advancing and receding of the water on the shore. When the water commenced to rise it came rushing up the river like a wave about three feet high. This phenomenon is doubtless owing to a storm of which we may hear in a few days having occurred somewhere on the Georgian Bay or Lake Huron."

The course of the storm seems to have followed the south shore of Georgian Bay, from Meaford to Collingwood Harbour, sweeping round the base of the Blue Mountains, and levelling in its passage very considerable tracts of forest.

A similar occurrence very probably took place a few miles east of Collingwood Harbour some years since, as recorded by wide areas of prostrate forest trees in the valley of the Nottawasaga River.

From Collingwood the general direction of the storm appears to have been towards Toronto, along the line of the Northern Railway. Its effects were particularly noticed at Barrie, Lefroy, Richmond Hill, Davenport, Toronto, in the township of Whitby and at Oshawa ; then it appears to have crossed Lake Ontario, and its outskirts reached and traversed the Line of the Rochester and Niagara Falls Railways. Its full force was probably felt at Niagara and Port Dalhousie. The hours at which the storm reached different localities are given below as far as we have been able to ascertain them :—Meaford (Georgian Bay), 4 a. m. ; Toronto, 6 a. m. ; Niagara, 6¾ a. m. We subjoin a number of extracts illustrating the effects of the storm and the Lake phenomena accompanying it :—

1. *Meaford, Township of St. Vincent.*—Wind blew a hurricane.—Hailstones of large size fell. Buildings unroofed.

2. *Lake Shore, from Meaford to Collingwood.*—A very considerable tract of the forest leveled.

3. *Collingwood.*—Houses unroofed—heavy timbers moved to some distance ; fishermen's boats carried some distance into the woods ; ice in Harbour broken up and blown out. Waters in the Harbour rising and falling continuously.

4. *Davenport (N.R.R.)*—Fences blown down.

5. *Toronto, 17th April, 8 p. m.*—Almost incessant sheet and forked Lightning in W. and N. W., illuminating some dense *cum. strat*, and which would otherwise have been invisible. Zenith clear.

10 *p.m.*—Constant sheet lightning round horizon.

Midnight.—Continued sheet lightning and distant thunder.

18*th April.*—During the greater part of the night there was a continued display of vivid lightning and a rumbling of distant thunder.

5·30 *a. m.*—Thunderstorm rising in N. W., the sky very dark and peculiarly threatening; very dense *cumulo stratus* rolling over with a rushing noise ; the wind for a few minutes (5·50 to 6·05 a.m.) was very violent, scattering the leaves and dust about in every direction. The rain drops which fell during the storm were large, and a few hailstones fell, which were generally ¼ of an inch in diameter.

6-30 *a. m.*—The storm was over, but the clouds were still rolling about in a very peculiar manner. Sultry morning.

8·00 *a. m.*—Detached clouds passing in almost opposite directions: the upper strata from S.W., the under rapidly from *East*.

The direction of the wind which was E. b. N. during the night, suddenly backed round the N. to N.N.W. at 6 a. m., but it returned to its original direction at 6.20 a.m. The velocity of the hour was about 13·0 miles, but from 5·55 to 6·05 it must have equalled the rate of 38 miles per hour.—*Extract from Met. Reg. Pro. Ob.*

INSTRUMENTAL OBSERVATIONS.

			Thermometer.		Hygrometric.		Wind.	
Day.	Hour.	Barom.	Dry.	Wet.	Elast.	Hum.	Direc.	Force.
			°	°				
17th	10 p. m.	29·625	47·6	46·0	·287	89	Calm	Calm
"	Midnight	29·611	47·4	46·0	·290	90	Calm	Calm
18th	6 a. m.	29·552	51·3	50·4	·350	94	E b N	11·2
"	8 a. m.	29·540	54·0	52·7	·375	91	East	8·3
"	2 p. m.	29·441	62·9	57·4	·400	71	Calm	Calm
"	4 p. m.	29·437	55·1	52·1	·349	81	Calm	Calm
"	10 p. m.	29·457	47·0	45·1	·273	86	E S E	1·6
"	Midnight	29·414	51·3	50·4	·350	94	N	1·0

REMARKS.

17th, 10 p. m.—Partially overcast. Sheet lightning round horizon.

Midnight.—Clouded, sheet lightning, and frogs croaking loudly. Distant thunder.

18th, 6 a. m.—See previous remarks.

8 a. m.—Mostly clear. Detached clouds passing in almost opposite directions. Mild morning.

2 p. m.—Detached clouds passing in Z., and hazy round horizon. Sultry close day.

4 p. m.—Light clouds and haze dispersed. Sultry and close.

10 p. m.—Overcast and haze. Some open spaces to N. W. Dark and close at night.

Midnight.—Densely overcast. Some heavy drops of rain at 10·45 p. m. Almost incessant forked lightning and distant thunder, from 10·30 p. m. in S. b. E and S. W. Commenced to rain again at 12·05 (only a few drops).—*Extract from Met. Reg. Pro. Ob.*

The waters in the Lake rose rapidly in the form of a huge advancing wave, and swept over the sand bar separating Ashbridge's Bay from Lake Ontario.

Fluctuations continued throughout the day, and were noticed in the Humber Bay.

Picton, 25th.—In Picton Harbour the water fell nearly three feet, and has not yet recovered its usual level. At Wellington, it fell between four and five feet, and although it returned after a few minutes, it is not yet within two feet of its former level. At South Bay, it receded forty-nine paces from the shore, and is still low.—*Picton Gazette.*

Putneyville (State of New York), 18th.—This morning, the Lake presented a different appearance from anything within the recollection of the oldest inhabitant. Soon after sun rise, the sky was overcast with dense clouds, and thunder was heard in the distance. For a short time the wind blew furiously, and the rain poured down in a copious shower. This was between 7 and 8 o'clock. The clouds thickened, and the darkness became almost appalling; one could not see to read or write without a candle.

The Lake rose and fell every eight or ten minutes, generally about two feet; but several times the difference between the highest and the lowest mark, was at least five feet. The water would rush up on the shore beyond its usual limits, and then recede after a few minutes several rods from the shore, leaving the stones and sand bare. Thus it would remain for, say, ten minutes, when it would roll gently back again to its former height. After 9 o'clock this agitation gradually subsided, and in the course of the day the Lake resumed its natural level.

D. C. Higgins.

The *American* gives an account of a similar ebbing and flowing at the mouth of the Genesee River. A captain who proposed to let his craft lie outside the piers till a favourable wind should spring up, states that suddenly a heavy tidal wave set *out from shore*, and left his vessel in water so shallow, as to cause it to careen quite on to the side. Soon after a return swell lifted her up again, and enabled him to make the harbor. It is evident from the description of these phenomena, noticed at points so many miles apart, that they proceeded from the same general cause, and were indeed parts of one and the same great tidal phenomenon.—*Rochester Daily Union.*

Seneca Lake.—During the whole of Wednesday and yesterday, the waters of Seneca Lake would rise and fall, in spaces of time varying from ten minutes to half an hour, continuously through those days, from five inches to two feet in height. Just after sundown on Wednesday evening, a friend of ours made an exact measurement of the fall and time. In fifteen minutes the water fell 16½ inches, when it commenced rising again.—*Seneca Lake.*

Niagara.—A little before seven, a. m., the sky assumed a green color, succeeded in a few minutes by a clear white, which indicated the presence of the hurricane. The storm came from the North, or N.N.E., apparently leaping in its course, and striking the ground at intervals with redoubled force. The rush of wind lasted about five minutes, and was at its height not more than one minute. But the damage it did was tremendous.

It struck the Niagara Car works, and in an instant levelled two large finishing shops, each 175 feet by 50, and two stories high, containing a number of new Cars, and took the roofs partly off some of the other buildings. A large new frame, 200 by 70, intended for a Foundry, and ready to be enclosed, was piled in a mass. The carpenter and blacksmith shops in the shipyard were blown down. The Engine House of the Erie and Ontario Railway was also very much twisted, and the large Woodshed nearly destroyed. A passenger Car was lifted bodily off the track near the station-house and thrown over to some distance from where it stood.

Throughout the Town the damage was very great—roofs, fences and chimnies blown down in all directions. The St. Andrew's Church received great injury—a third of the roof and gallery inside was swept away.

During the hurricane the water suddenly rose from five to eight feet along the Lake shore and in the river.—*Mail.*

Port Dalhousie.—For two or three hours after sunrise the heat was very oppressive. Off to the north, over the Lake, the clouds presented an unusually wild, lowering, I may say dreadful, appearance. Banks of fog would rise suddenly in the direction of Toronto, whirling about wildly, and then form into horizontal streaks of a dark leaden hue. About 6 o'clock, a. m., a black cloud came drifting along towards the shore with great velocity. It appeared to pass too high to do much damage in the port, but about half a mile inland it descended to the level of the earth with full force, and scattered fences as if they had been chaff. Fortunately the squall here was only a few yards wide, and it appeared to have risen again, after passing about a quarter of a mile across the country, as I have heard of no damage being done save in the one spot. The air continued perfectly tranquil a few yards from where the squall was passing. Shortly after this cloud had passed, a dark hue appeared to move along the surface of the lake towards the shore, which, as it drew nearer, was discovered to be a huge wave. It came rolling forward, apparently about 6 or 7 feet high at its crest, and dashed against the piers and swept far up on the shore. One large three masted vessel was torn from her moorings and dashed against the pier, but without being seriously damaged. The huge wave, however, retreated as rapidly as it advanced, and carried with it the water to a depth of four or five feet, leaving only a narrow stream where there is usually a sheet of water about a quarter of a mile wide. Each time the wave receded a number of fine fish were left floundering in the mud and shallow pools. The water continued receding and advancing in this manner the whole day, but it gradually diminished in force and volume towards the evening. It flowed in, on each occasion, for about half an hour, and receded for the same length of time. It was noticed that when it turned shorewards, there was a chill puff of wind from the north.

At Wellington, the water at the Lake shore acted precisely as described above. The water receded from Mr. McFaul's wharf so that parties could walk round it; then again the water came back and overflowed, rising from four to eight feet over its usual level. For a day or two the Lake appeared more or less unsettled.

Sir Henry de la Beche and Mr. Greenough.

The loss in one week of two eminent geologists is a severe blow to science. The name of Sir Henry de la Beche will be more familiar to our readers than that of Mr. Greenough. The director of the geological survey has been prominently before the public for many years. The father of the Geological Society was a worker rather than a writer; though seventy-seven years of age when he died, yet the greater portion of his life was spent in the pursuit and accumulation of facts. Sir Henry de la Beche was born in London in 1796, and was therefore only 59 years old at his death.

In 1810, Mr. De la Beche entered the Royal Military College; on

leaving which he entered the army, but in a little time he resigned the profession of arms for the pursuits of science, thus resembling another great geologist, Sir R. Murchison.

He gave himself up to the study of Geology, and made it the business of his life.* In 1817 he became a member of the Geological Society, then in the tenth year of its existence.

The year 1819 was spent by Mr. De la Beche in an examination of the geological formations of Switzerland and Italy, and his zealous prosecution of similar inquiries led to his being elected in that year a Fellow of the Royal Society. In 1820 a paper by Mr. De la Beche, 'On the Temperature and Depth of the Lake of Geneva,' the result of a most careful examination, was published in the *Edinburgh Philosophical Journal*. In his geological investigations of the British rocks the Rev. Wm. Conybeare, now the Dean of Llandaff, was, to some extent, connected with Mr. De la Beche; and his first communication to the Geological Society was the joint production of these two geologists,—announcing the discovery of a new fossil animal of the Saurian family, in the lias limestones of Bristol, which they named, as being distinctive of its species, the Plesiosaurus. From this time the name of De la Beche became closely connected with the science of the day. Many valuable papers were communicated to the Geological Society, including an elaborate account of the Geology of Switzerland; the Fossil Plants found at the Col de Balme, near Chamouny; a communication on the Geology of the Coast of France; and several papers on the Geology of various districts in the British Isles,—especially of Southern Pembrokeshire, of Lyme Regis, Dorsetshire, and of Beer in Devonshire.

Mr. De la Beche possessed extensive estates in Jamaica. He now visited his property,—Halse Town, in the neighbourhood of Spanish Town,—and on his return, in 1825, he communicated to the Geological Society his remarks on the geology of that West Indian island, of which nothing had been known previously.

Between 1827 and 1830, Mr. De la Beche published numerous important Geological papers in the *Transactions* of the Society, the *Philosophical Magazine*, and the *Annals of Philosophy*, and also a tabular proportional view of the superior, supermedial, and the medial rocks. In 1830 his first book, 'Geological Notes,' appeared; and in the same year, 'Sections and Views of Geological Phenomena.' Great skill in the use of the pencil enabled the author to furnish the whole of the drawings for these works, and to them all subsequent illustrators have been indebted. 'The Geological Manual' was published in 1831, and was speedily translated into French and German,—becoming a text-book for geologists throughout Europe, and passing through several editions. In 1832 Mr. De la Beche proposed to the Government to supply the data fer colouring geologically the maps, then in progress of publication, of the Ordnance Trigonometrical Survey. This offer was accepted, and at the Land's End, in Cornwall, was commenced the great work of this eminent geologist's life. Mr. De la Beche, who bore himself the greater part of the expense of the Geological Survey of Cornwall, devoted several years to a careful investigation of all the conditions, lithological and mineralogical, of Western England; and he published a series of Maps of Cornwall, Devonshire, and Somerset, which exhibited a correctness and detail such as had never before been attained. This Survey was fairly established under the Ordnance. "It was,"—says Sir Henry De la Beche, in his Inaugural Discourse, delivered at the opening of the School of Mines, on the 6th of November, 1851,—"It was while (in 1835) conducting the Geological Survey then in progress, under the Ordnance, in Cornwall, that being forcibly impressed that this Survey presented an opportunity not likely to recur, of illustrating the usefnl applications of geology, I ventured to suggest to Mr. Spring Rice (now Lord Monteagle), then Chancellor of the Exchequer, that a collection should be formed, and placed under the charge of the Office of Works, containing specimens of the various mineral substances used for roads, in constructing public works or buildings, employed for useful purposes, or from which useful metals were extracted, and that it should be arranged with every reference to instruction; as by the adoption of this course a large amount of information, which was scattered, might be condensed, and those interested be enabled to judge how far our known mineral wealth might be rendered available for any undertaking they are required to direct, or may be anxious to promote, for the good or ornament of their country." Being supported in this recommendation the nucleus of the Museum of Practical Geology was formed.

In 1848, the honour of knighthood was bestowed on the Director of the Geological Survey; and in addition to this honour, in 1853 Sir Henry De la Beche was elected, by the suffrages of forty-seven members, Corresponding Member of the Academy of Sciences of Paris. The Order of the Dannebrogg was bestowed on him by the King of Denmark; and he received the Order of Leopold from the King of the Belgians.

Beyond the works and papers which we have enumerated, Sir Henry De la Beche published a voluminous report on the 'Geological Survey of Cornwall, Devonshire, and West Somerset,' 'Researches in Theoretical Geology,' and 'How to Observe.' In the various journals will be found forty papers and memoirs; and in 1851 Sir Henry De la Beche completed his last work, 'The Geological Observer,' founded upon his former work 'How to Observe.' In all these productions will be discerned a minuteness of detail and an excellence of illustration which mark the rare union of a skilful scientific observer and a finished illustrative draughtsman.

Although paralysis was seen by his anxious friends to be slowly but surely spreading its fatal influences over his once energetic frame, Sir Henry De la Beche would not allow himself repose. The labours of the Geological Survey and the business of the Museum engaged his attention daily,—and even two days before his death he spent several hours in the Museum directing the business of that establishment with his usual acuteness, although then powerless to move himself.

Sir Henry De la Beche raised for himself a splendid memorial of his talents and his zeal, and he created for the public an establishment which cannot but prove eminently useful, if it be carried onward in the spirit and with that well defined idea—which has been the creative power and the sustaining influence—under which the Museum of Practical Geology and the School of Mines were formed and have been supported.

Mr. Greenough, born in 1778, and consequently seventy-seven when he died, was educated at Cambridge and Göttingen, and served in Parliament for the borough of Gatton. But he made no great figure in the House of Commons. His genius was a genius for map-making, not for speeches and legislation; and the records of his zeal which remain to tell posterity of his useful labours are 'The Geological Map of England and Wales,' the map of 'Hindústan,' and the 'General Sketches of the Physical Features of British India.' He was on a journey to the East, in hopes of collecting materials for new maps, when he died at Naples; and it is understood that he has left behind a vast accumulation of materials, some of which will doubtless be available for the press.

Mr. Greenough had a great reputation among men of science, without being very widely known to the British public. More than thirty years ago he published his one volume, 'A Critical Examination of the First Principles of Geology.' Addresses and discourses to scientific Societies followed from time to time; but not with that persistence of assault by which literary fame can alone be carried. Yet was Mr. Greenough considered by English Geologists as the leader of their band, and he was one of the founders and was the first President of the London Geological Society.

The Antiquities of Canusium. (Apulia.)

The tomb which has most recently been brought to light has much of an Oriental character, as the doors narrow towards the top. The colour of the ground is of a dark red and blue. The chamber facing the entrance appears to have been devoted to the chief of the family, whilst the lateral ones were occupied by the women; and there, on beds of bronze, decorated with ivory statuettes and other ornaments, were found female skeletons. All that beauty, all that wealth ever gave could not save them from the universal lot. The ground was covered over with gold thread, which Signor Bonucci supposes to be the remains of a golden carpet or cloth; whilst round the walls were disposed more than forty vases, of various though graceful and elegant shapes. In some pateræ of an enormous size, eggs and other eatables were found, as also the dregs of some liquids. In harmony with the idea that the deceased would resume the habits of this life in another world, the skeletons bear upon them the traces of the most magnificent dresses. The principal female figure, for instance, was found with ear-rings representing two peacocks, not merely in shape but in every tint: the colour of the plumage being given by smalt upon gold. Golden bracelets of a serpent form surrounded dry bones, round which once beat the pulses of passion. Her vest must evidently have been embroidered, for garlands of myrtle, both the leaf and the berry, were found in gold, and all are clearly pierced with the holes by which

* See *Athenæum* for April 21st, 1855.

they were once attached to the dress. Round the head was a diadem of various flowers, the cups of which were formed of rubies and jacynths and emeralds of great beauty, and sometimes of smalts of different colours. A beautiful ring was found on one of the fingers of this female. The circle is formed of two clubs of Hercules, the point where they meet beneath being surmounted by a ruby; whilst on the upper and opposite part of the ring is a box, where might have been the hair of a lover or Persian perfumes: the cover is formed of a large emerald. The work is of the most delicate filagree, displaying a great variety of beautiful forms: in short, all regard it with astonishment, and doubt whether modern art could produce anything so perfect. Signor Bonucci supposes that the age of the tomb may be about that of Alexander the Great, or, at least, 2000 years. The art of the painter, and the potter, and the sculptor, and the architect of that time is brought before us as fresh as though it had been executed but yesterday; nay, more, the handiwork of the milliner and the upholsterer is shown to our wondering eyes; and, dressed in the habiliments of the drawing-room, the inmates of the tombs seem ready to receive us.

The Ash Mounds of Jerusalem.

In a letter to the London *Athenæum*, Mr. Finn, the British Consul at Jerusalem, gives a description of the "Ash Mounds" near Jerusalem, and mention some curious results of their examination which may lead to important and highly interesting discoveries.

"Outside of this city (Jerusalem) towards the north-west, and not far from the Nablus Road and the Tombs of the Kings (so called), are some considerable heaps of blue grey ashes, on which no grass or weeds ever grow. One of them may be 40 feet in height. They are remarkable objects in themselves, especially as contrasted in colour with the dark olive groves around them. Hitherto it has been questionable whether the two ash-hills without the Damascus Gate have been heaped up from the ashes of the burnt sacrifices, or from the residuum of the produce of potash in the soap manufactories here. Dr. Roth, who had taken with him two samples, states 'that their analysis in our famous Liebig's laboratory bears evidence to the supposition that those ashes are the remnant of the *burnt sacrifices*, because they are *chiefly of animal*, and not of vegetable origin; and even contain small fragments of bones and teeth burnt to coal; and yet it would be impossible to ascertain the species of the animals to which they belonged.' The analysis exhibits a small percentage of *silicic acid*, which is never found in the ashes of flesh or bones. Dr. Roth is of opinion that we may account for this circumstance by supposing that the ashes of the *meat-offerings* in which silicium may be found, were likewise carried off to the hills in question. The samples were taken both from the top and the basis of the larger hill,—not just from the surface, nor from a considerable depth either.

This almost unexpected result is one that leads to important antiquarian consequences,—not only exciting wonder at the confirmation of Holy Writ, and bringing our feelings back to immediate contact with those of the Aaronic priesthood, but as helping among other facts to determine the course of the ancient walls, since these ashes must have been thrown beyond the wall.

The Relations of Lead to Air and Water.

Dr. Christison states that "water containing 1-1000 or 1-1200 part of salts, may be safely conveyed in lead pipes, if the salts are chiefly sulphates and carbonates; and that lead pipes cannot be safely used when it contains 1-4000th part of saline matter, if this consists of muriates."

At the request of the Board of Consulting Physicians of the city of Boston, Prof. E. N. Horsford, of Cambridge, U. S., in 1849 examined, with great care, the relations of lead to air and water, and gives the following as his conclusions: "A coat of greater or less permeability forms in all natural waters to which lead is exposed. The first coat is a simple sub-oxide, absolutely insoluble in water, and solutions of salts generally. This becomes converted in some waters into a higher oxide; and this higher oxide, uniting with water and carbonic acid, forms a coat soluble in from 7000 to 10,000 times its weight of pure water. The above oxide unites with sulphuric and other acids, which sometimes enter into the constitution of the last coat; uniting with organic matter and iron rust, it forms another coat, which is in the highest degree protective."

Dr. Horatio Adams, in a lengthy and very able report, before the American Medical Association, at its annual meeting, in 1852, deprecates the use of lead pipe for the conveyance of water, under any circumstances. Having shown, both by analysis, and its effects on the system, that lead is present in the Cochituate water drawn through lead pipes, also in the Croton water, the New Orleans water, the Cincinnati and Louisville water, he concludes—"That it is never safe to use water drawn through lead pipes, or stored in leaden cisterns, for domestic purposes; and that any article of food or drink is dangerous to health which, by any possiblity, can be impregnated with saturnine matter."

Gmelin, a distinguished German chemist, does not differ from Christison.

Salubrity of Towns.

M. Junod, of the French Institute, has communicated to that body some interesting facts respecting the relative salubrity of parts of cities according to their aspect and position. He says that in most European cities, the wealthier and more intelligent portion of the inhabitants have settled upon and occupied the western districts, while in the eastern parts have been located the working classes and trading population. This is the case not only in London and Paris, but also at Berlin, St. Petersburg, and Vienna. The old Italian cities exhibit the same peculiarity, and all their cemeteries are situated eastward. M. Junod endeavours to prove that these arrangements are in strict accordance with reason, and are based on a natural law. During westerly winds, the barometer in general is very depressed, and all the evaporations of the earth, as well as the smoke and other emanations from the burning of fuel, descend and remain near the surface. When, on the contrary, easterly winds prevail, the barometer ranges high, and the air becomes purified, as all vapours ascend, and soon disappear. If, therefore, westerly winds blow, they convey to the inhabitants of the eastern districts the unwholesome exhalations and vapours of the west; whereas the western districts receive only the purer air of the surrounding country. If easterly winds prevail, the noxious vapours of the eastern districts become scattered before they reach the western portions of the city.

From these observations the following inferences are deduced. Considerations of health ought to induce a preference for the building of residences in the western portion of a city. And, on the contrary, all the trades and occupations which are of an unwholesome nature, or which produce and emit smoke, steam, or other offensive exhalations, should be consigned to the eastward. Even in single dwellings, it is expedient to plan the kitchens, larders, washhouses, &c., to face the east.

Cholera and the Water Supply.

The connection between the prevalence of epidemic cholera and the impurity of the water used for domestic purposes has frequently been pointed out. In a paper read before the London Chemical Society in April last by Dr. Thomson, samples of Thames water taken from service pipes in localities where the mortality was great were exhibited, which contained most striking indications of the presence of sewerage. Not only was nitric acid detected in all of them, but ammonia was distilled over in considerable quantities, and sulphate of ammonia prepared by this process was exhibited to the Meeting. The mechanical impurities gave equally strong evidence to the same purport, being composed of vegetable and animal organisms, &c.,—and even the *debris* of human food can be demonstrated with the greatest facility by the microscope in the sediment derived from the service-pipes in those waters which are pumped from the lower sources of the Thames.

Dr. Thomson considers Dr. Clarke's plan for softening hard water perfectly practicable; and suggests that in order to adopt a uniform scale by which to measure the amount of foreign matter in water; distilled water should be represented by 0°, and every grain of matter present in solution in water per gallon by a degree; so that waters may be described as being possessed of so many degrees of mechanical, organic, and inorganic impurity respectively.

Meeting of Dr. Barth and Dr. Vogel.*

On the 1st of December, 1854, it fell to the share of Dr. Barth—he who had already been believed dead—to meet in "very good health and spirits" Dr. Vogel:—to see once more the face of a European and grasp the hand of a countryman who had been sent to join him.

Dr. Vogel had left Kuka iu the latter eud of November, to proceed in a westerly direction *en route* for Ziuder, the nerth-western frontier town of the Empire of Boruu,—being anxious to extend his astronomical and other observations to that place. Happily in the beginning of the journey, he received a letter from Dr. Barth, dated Kano, the 24th of October; aud this was the first direct news he had received from him. According to this letter, Dr. Barth had left Kano *en route* for Kuka, about the same time that Dr. Vogel had departed from the latter place to proceed westward, on the very road which the former had chosen. Thus, both travellers had started to meet without knowing it themselves. Dr. Vogel, keeping on the Kano road, and leaving Zinder on the right had the happiness to fall in with Dr. Barth at Bundi, a small town situated about 110 geographical miles north-east from Kano, and nearly 200 geographical miles due west from Kuka. As only a few preliminary hasty lines from Dr. Vogel, written in pencil, have come to hand, the particulars of this event have not yet transpired; but it may easily be conceived what it must have been to Dr. Barth. It was exactly six years since he left Europe, in company with Mr. Richardson and Dr. Overweg; aud since the decease of the latter, on the 27th of September, 1852, not only had his communications with Europe been all but entirely cut off, but he had indeed been isolated from the civilized world, and left to battle with manifold hardships and dangers.

Dr. Vogel writes, that Dr. Barth had moved on to Kuka, whence he intended to proceed, without further delay, home, *via* Murzuk and Tripoli. As to himself, he continued his journey to Zinder; wheuce he despatched a letter with the above news, dated the 7th of December last, and which took nearly four months to reach Tripoli by way of Ghadamis.

Since the above was written, letters from Dr. Barth himself have come to my hands, which, though written before his meeting with Dr. Vogel, are of great interest, as they contain the first news respecting his journey from Timbuktu back to Sudan, and the first positive information ever received from a European traveller of the River Kowara between that place and its lower course

It appears that Dr. Barth had been detained at or near Timbuktu several months beyond the date of his last letters despatched from that region, namely, the 23rd of March, 1854, between which date aud the time of his arrival at Kano, which took place on the 17th of October last, nearly seven months intervene. Dr. Barth himself says:—"After a protracted stay of *nearly a year* at Timbuktu—the "Queen of the Desert," as it is justly called by the natives—I retraced my steps eastwards along the shores of that maguificent river, which the undaunted Scotchman [Mungo Park] descended about fifty years since, fighting his way through numerous fleets manned by Tuaricks and Sudans—lost labor to science, his journal having perished with him;—while I went along reconciling and befriending those very people, and obtaining full security from their chiefs for any English visiting their territories, whether by land or by water." Thus, Dr. Barth has been able to realize his great wish, namely, to trace this river between Timbuktu and Say; which latter place is situated in about 13° 10′ north lat. and 3° east long., Greenwich. This, its middle course, seems everywhere navigable and enlivened with large fleets, its shores densely inhabited by people, who received and treated Dr. Barth most kindly, and implored him to stay with them altogether, or to return soon in an English ship. They learned from him with astonishment as to whence the river—which forms the basis of their existence aud wealth—comes from, and where it terminates.

Dr. Barth alludes to a large map of the river drawn by him, which he had sent to the Foreign Office. He has also transmitted with the present letters some of a former date, which has been despatched by him while on his way to Timbuktu, but which, as he found on his return to Sudan, had not been forwarded, probably, because their envelopes and addresses had been lost. These letters are dated "Dore, in Libtako, 16th July, 1853," which is about midway between Sokoto and Timbuktu (see map in my 'Geographische Mittheilungen,' part I.), or in lat. 14° 30′ north, and close upon the meridian of Greenwich, and they contain a full account respecting that region, which was entirely unknown before.

Libtako forms a portion of the very extensive Fellata dominions, and is a very important commercial point. The principal article of trade is the salt of Taodenni, which is brought thither by the Arabs of Timbuktu, while the Tuaricks bring corn and butter, the people of Mosi their celebrated donkeys and their famous cotton manufactures, cheap black shirts and a large peculiar kind of guro nuts. The inhabitants of the country supply sweet and sour milk, and their manufactures consist chiefly of very handsome aud cheap shawls made of cotton and wool, and of various colours. The market at Dore, the chief place of Libtako, is held every day. Cowries are almost the sole medium of interchange.

Libtako occupies an elevated, dreary plain, devoid of trees and shrubs, and suffering from the want of rain. Granite protrudes in many places out of the soil. Dr. Barth made many enquiries respecting the town of Adafudia, reached by Mr. Duncan, and which, according to the position assigned to it by that traveller, ought to be within 100 geographical miles from Libtako—but in vain; he could hear nothing whatever of it. Though the country was in a state of anarchy when Dr. Barth passed through it, he did not suffer on that account, but rather from the too exalted manner in which he was received everywhere, the inhabitants flocking from all quarters to receive his blessing. The Arabs looked upon him as no common Christian, owing to the information he possessed of topics specially interesting to themselves, and to the fact of his coming from the East. The Tillahas had christened him "Môdibo," by which name he was universally known in those countries.

It was near Libtako where Barth was so fortunate as to make the acquaintance of one of the followers of the Sheikh el Bakay—the Pope of Timbuktu,—who subsequently became his best friend and greatest benefactor. This person exercises his influence over a very exteusive region, nearly as far as Sokoto in the east; and he may be said to have created of Timbuktu a kind of African Rome,—the centre of the power of Islam.

The region between Libtako in the west and the river Kowara (here called Tsa, Say or Mayo) in the east is occupied by territories belonging to the large country of Gurma, only the northern part of which belongs to the Fellatas. The language of Gurma, has a few words in common with that of Benin. Within Gurma are various rivers, all tributaries of the Kowara, the largest being the Sirba, which Barth found twelve feet deep in the beginning of July, and which he had to cross by means of immense bundles of reeds fastened together, as boats are entirely wanting. The valley of the Sirba is very ill-famed as being most destructive to all kinds of cattle aud horses. The soil along the course of the river swarms with black worms.

Dr. Barth's letters contaiu interesting extracts from the "Tarikh el Sudan," an important work on the history of Sudan, hitherto unknown.

On his arrival at Kano, in October last, Dr. Barth, instead of finding letters and supplies from home, received information of the rumour of his death having been spread in Sudan, and even reached Europe, about which, not knowing exactly the origin and circumstances connected with it, he felt very sore and indignant, while the absence of all needful supplies put him to great straits and inconvenience. Happily these, as we know, he subsequently got over. His longing to reach Europe knew no bounds, as he declares that the being exposed to another rainy season (the sixth), or to remain much longer without the refreshing influence of European atmosphere and proper food, would be his certain death. Yet in the same sentence he speaks of ultimately returning to the field of his labours, and trying to penetrate into the interior of Africa from the coast of Zanzibar, after having strengthened his health!

The only cause of joy which awaited him in Kano was the news of the success of the Chadda Expedition, of which he seemed to have learnt all the particulars from the natives. Among others, he met an old acquaintance, the Governor of Hamarrua, a country situated on the shores of the upper course of the Chadda. This person told him that the exploring steamer Pleiad had also reached his country, that he had received the Expedition very friendly, and had made the commander a present of six oxen.

AUGUSTUS PETERMANN.

* *Athenæum.*

Novel Arrangement of Picture Galleries.

After the late M. Rothmann had acquired a great reputation as a landscape painter, King Louis of Bavaria sent him to Greece, where that artist produced works highly spoken of by the German press. Some consider them the *ne plus ultra* of landscape delineation, each painting being a poem, representing in the perfect concordance of

earth, light, and air, the incorporate image of some ideal harmony; we are struck, moreover, by an objective adherence to nature, and the utmost faithfulness of a positive locality, its picturesque and vegetative physiognomy. It is as if the Athenians, the Spartans, arose anew from their resting-place of ages,—as if a battle was again to be fought on those spots so intimately represented in the Eleusian groves, once the place of sacred initiation. Such appreciation led to the desire of having these productions of art exhibited in the best possible manner, and an especial saloon has been appropriated to them in the new Pinakotheca, at Munich. The architect, M. Voit, being intrusted with its construction, has erected a gallery, where the light coming from above strikes only the pictures, the visitor viewing them from the shade of a covered hall, which occupies the middle portion of the room. By this arrangement, the paintings are brought out in a very striking illumination, imparting to them that mysterious sentiment, under which, without doubt, most works of art ought to be viewed.

Progress of Melbourne—Australia.

A view of the commerce, revenue, and rise, of Melbourne, is unlike the commercial growth of a rising city, and rather resembles youth starting up at a bound to the full maturity of manhood: its population, which in 1836 was 224 persons, having reached in 1853, 250,000. Its exports, which in 1838 amounted to 21,000*l.*, reached in 1850 to 1,042,000*l.*, in 1852 amounted to 7,451,540*l.*, and in 1853 swelled to 9,080,574*l.*; while the increase of imports in the same year was equally striking, advancing from 71,000*l.* in 1838, to 754,000*l.* in 1850, to 4,067,742*l.* in 1852, and to 15,842,637*l.* in 1853. The revenue of the colony is also very remarkable—in 1850 it amounted to 261,321*l.*, in 1851 it was 379,824*l.* in 1852 it reached to 1,576,-801*l.*, and, in 1853, it swelled to 3,202,249*l.* A large part of these amounts was obtained from the sale of Crown lands, and the licenses to dig for gold yielded, in 1853, 660,838*l.*, the present reduced rate being 1*l.* per month, or 8*l.* for the year. The total produce of gold for 1853 was nearly 129 tons, valued, at 4*l.* per oz., 12,361,368*l.*, being upwards of 1,000,000*l.* a month; but, as we learn from the most recent advices, that the amount of gold shipped from Victoria, in the first nine months of 1854, amounted to 1,653,999 ozs., against 1,831,468 ozs. shipped during the first nine months of 1853, some decline will be observable during the last year. This is attributed, partly to the fact that a large part of the population has settled down to ordinary industrial, particularly agricultural pursuits, but still the average weekly produce in October last was about 40,000 ounces.—*Min. Jour.*

The Great Minnesota Copper Mine.

The Lake Superior *Mining News* furnishes the subjoined summary account of the monster mine, known as the Minnesota:—

"The greatest depth attained in this mine is 380 feet. The main shaft or piston that works the pumps is here about 300 feet long. The lowest depth attained at the south vein is 166 feet. Silver is interspersed in all the copper of this mine, and in some others on this range. When any fine specimens of silver do make their appearance in *verges*, or in any other collection, they are generally secured by the miners. The amount of copper shipped from this mine during the season of navigation was 1,543,407 pounds, net weight, being over 771 tons, worth over $300,000. The product for the month of December is over 77 tons. Three hundred and ninety men are required to carry on this vast operation. It requires a supply of over 20,000 pounds of candles for this mine during six months. There are about forty buildings clustered around this mine, and making a respectable village, for they have their Catholic and Protestant churches, their school-house, warehouse, and doctor's office. It is one of the mines that give character to this country, for upon its success depends the confidence of all stockholders in copper mines; and it will maintain that place until some others shall show an equal success, and share that responsibility with the Minnesota and Cliff mines."

Miners and their Privations.

The census of 1851 presents many curious facts relating to mining industry. It appears that in Great Britain this class of the population numbered as follows:—

		Production in 1851 about
Coal miners	216,366	52,000,000 tons of ore.
Iron miners	27,098	2,250,000 "
Lead miners	21,617	65,000 "
Copper miners	18,468	11,000 "
Tin miners	12,912	9,000 "

This population, in a great measure, exists in mines which are distinguished from the workshops of other operatives by the peculiarities of the temperature, pressure, moisture, and composition of the air, of the gases, and miasmata which prevail in them, by the absence of sunlight, and by the mode of lighting, quite as much as the motions and working positions of the men differ from those belonging to any other occupation. The average age of miners living varies from 25·7 years in the case of tin miners, to 28·9 amongst lead miners, being a difference of about three years, but this is accounted for by the tin miners commencing work at $10\frac{1}{2}$ years of age, the lead miners not till above thirteen years, on the average. These are the extremes of age, within which, on an average, each of the five classes of miners begin work. Iron miners are the unhealthiest of all; for, notwithstanding that the men do not commence work till about 13 or 14 years of age, their span of labour only reaches 25·4 years, which is $2\frac{1}{4}$ years below the average time in which a miner wears out. The machine lasts but 27·7 years, whilst 42·3 years are got out of the agricultural labourer. In other words, the lives of the miners, in addition to excessive sickness and diminished strength, are shortened by an amount equivalent to more than half their working life.

Lightening of Labour in Mines—the Man Machine.

The "Man Machine" is an apparatus contrived for the purpose of saving miners time and labour in ascending and descending to and from their work. One hundred men can be elevated or lowered together from as many different depths of the mine (in a perpendicular shaft) by this simple contrivance. The single acting man machine consists of a strong rod of wood or iron, extending the whole depth of the shaft, to which are fixed platforms about 4 feet by $2\frac{1}{2}$ feet at intervals of ten feet. There are corresponding platforms fixed at the same distances to the sides of the shaft. The rod has a reciprocating motion up and down of ten feet, communicated to it by the crank of a water-wheel or steam-engine. Now, a person stepping on the rod when it is about to go up, and off it on to the side platform when it is about to go down, and repeating the operation at every stroke of the rod, would arrive without effort at the top. One man can be on each platform at a time. In the double machine there are two rods, which move up and down alternately; and, therefore, double the speed of the ascent.

The Canadian Journal—New Series.

The members of the Canadian Institute and the subscribers to this Journal are aware that the first number of the *Canadian Journal* was issued in August, 1852. Each yearly volume was thus made to terminate at a period found by experience to be extremely inconvenient in relation to the Society's financial arrangements; and it has long been thought desirable, that an effort should be made to connect the financial year of the Institute with that of its Journal. This step has not hitherto been taken, as it appeared to the Council that the prospects of the Society were such as would warrant the issue in a short period of a NEW SERIES, with such changes in size, form and arrangement, as would adapt it to to the rapid growth and strength of the Canadian Institute. It is now thought that the time has arrived for effecting this change, and it is therefore proposed to continue the monthly issues of the present volume to December 1855; and in January 1856 to issue the first number of a NEW SERIES. Further information on this subject will be published when the necessary details have been determined.

Canadian Saturniæ.—Silkworms.

In the April number of the *Canadian Journal* of last year (vol. ii. page 212) we published a short paper by Thomas Cottle, M.D., of Woodstock, C. W. "On some of the Canadian Saturniæ, and suggestions on the possibility of using their silk for textile purposes."* We are glad to find in the correspondence of M. Jerome Nicklès with "The American Journal of Science and Art," dated December 30th, 1854; that the French "Zoological Society for Acclimation and Domestica-

* Read before the Canadian Institute March 11th, 1854.

tion," have directed their attention to the Saturniæ, with a view to their acclimation. M. Nicklès says :—

" Since the muscardine has made so great ravages among the mulberry silkworm, there has been an attempt to introduce other kinds of silkworms. I have already spoken of the Bombyx of the Ricinus. It is now proposed to acclimate three American species of Bombyx ; the *Cecropia* whose larvæ feed on leaves of the willow and may be fed also on the plum ; the *Luna*, an elegant species of a green color, which lives on the Liquidambar, and which will also eat the leaves of different species of walnut ; the *Polyphemus*, a large *Attacus*, of a brownish gray color, which feeds on the apple, oak, beech, &c. These three species are abundant in the woods of Louisiana, Georgia and South Carolina. Their silk is of inferior quality ; but it costs so little to obtain it, that the acclimation of the species is regarded as desirable on the score of economy."

It may be a novelty to some of the members of the " Society for Acclimation," to find that the three magnificent insects alluded to in the foregoing paragraph are found in Canada, oue species in great abundance ; and the question of using their silk for textile purposes, has not only been suggested, but actually tried on a small scale, and found quite practicable.

Canada West—Information for Intending Emigrants.

Mr. Commissioner Widder has recently published a fourth edition of a little pamphlet containing auswers to questions respecting the climate, soil, husbandry, state of education, &c., in Western Canada. The former editions have been widely circulated in the United Kingdom and in Germany. The very remarkable changes, however, which have occurred in Canada during the last three years, by the construction of railways and the introduction of foreign capital, have rendered it advisable to prepare a new and revised edition, extended to the present time.

In the preface to the new edition, Mr. Widder alludes to the general condition of the Province in 1855, and draws an encouraging picture of the stability of its present prosperity and the certainty of future rapid advancement.

INTRODUCTION TO FOURTH EDITION.

" During the last three years, a combination of circumstances has caused a most extraordinary change in the relative position of everything. The price of land, of labour, of provisions,—in fact, of everything, has advanced. The inducing causes have, no doubt, been most materially the introduction of railroads,—the demand for labour arising from them,—the large amount of money disbursed for the works, and also brought to this Province for investment,—together with the high prices obtained for the past two years' harvests ; to which must be added the large emigration from Europe, and of settlers from the United States, seeking this Province as their adopted home.

" Those events continued to stimulate great progress in our affairs, until the effects of the Russian war acted upon the money market in England, and were more deeply felt in Canada, superinduced upon the very large importation of goods from Europe and the United States, and the great depreciation in the price of lumber.

" A check was given to our Railway Works—and Remittances for investments became limited. No monetary crisis, however, arose from these occurrences—they merely caused a suspension in our rapid advancement. At the same time, the wealthy condition of the farmers, and the great demand for produce, advanced the prices of their productions, and that of Wild Land, and of all Real Estate, and affirmed the substantial position which the Province has acquired. It may be said we are simply pausing for breath, after the recent excitement, and that we are about recruiting ourselves for a new start in our career ; which it is believed will be a more permanent and important one, in its results of positive progress and prosperity, than has hitherto been witnessed. But this state of transition throws embarrassment around the desire to give perfect data and unchangeable prices, such as is desired in a work of this description ; for a continuance of the war, the scarcity of money, and the suspension of our public works, or bad harvests, may seriously affect the data given ; on the other hand, a contrary position of those affairs, would place this Province in a most extraordinary state of prosperity. Nor should it be forgotten that we are about reaping the advantages of an extended commerce with the United States, through the Reciprocity Act ; which cannot fail to be of great importance to us.

" With reference to the imports, the following statement, from the official returns, will prove extremely interesting, as showing the very great increase in the trade of the Province during the past four years, and its great power of consumption of goods induced by its prosperity :

COMPARATIVE STATEMENT OF IMPORTS,

Exhibiting in contrast the Value and Amount of Duties collected on Goods entered for consumption in Canada, during the years 1850, 1851, 1852, 1853, *and* 1854, *respectively.*

WHENCE IMPORTED.	VALUE.				
	1850.	1851.	1852.	1853.	1854.
Great Britain	£2,407,980	£3,012,033	£2,667,783	£4,622,280	£5,740,832
N. American Colonies...	96,404	109,242	120,238	158,164	168,778
West Indies...............	1,112	3,406	1,278	869	668
United States	1,648,715	2,091,441	2,119,423	2,945,536	3,883,274
Other foreign countries	91,303	142,574	162,899	268,507	338,777
Totals............	4,245,517	5,358,697	5,071,623	7,995,359	10,132,331
Duty on the above......	615,694	737,439	739,263	1,028,676	1,224,751

" To any one in Europe who may have been sceptical of the necessity or advantages of railways in this Province, or that they could be supported, with a prospect of a fair return on the capital invested in them, a most convincing argument is set forth in the Returns of the Great Western Railway Company of Canada, opened in January, 1854, which show that the revenue for the six months ending in January last, amounted to £192,719.

" The views adopted in Europe, upon railroads, are not applicable to this country. *There*, railroads are the consequences of the requirements for quick and cheap conveyance of a dense population, and of its manufactures and productions ; *here*, railroads are self-creative of support, by raising population,—through opening up a new and fertile country, which transmits its productions, in return for the supplies of its wants.

" The effects of railroads upon the prices of produce, will probably be, to equalize them throughout the Province ; whilst it can scarcely be expected they will reduce the cost of living, in the towns and ports where the railroads have their termini and depôts for exportation and importatiou. The requisite shipping, the great trade and commerce, combined with the docks for ship-building, and manufactories, that will necessarily arise, will induce a consequent increased permanent and transient population, who must be supplied, and can well pay for their wants. Such has been the effect upon the cities of New York and Boston, and other places similarly situated. As to real estate, it must, from the same causes, be affected in a like manner, in the towns and ports ; whilst farm lands will, in every manner, be greatly benefited by railroads. About five years since, the price per acre for lands in the Genesee Country, and other parts of the State of New York, was from £12 10s. to £18 10s. ; they are now selling at £18 to £25 per acre, including the ordinary farm-buildings ; these are cleared lands, but the value of the timber would have been greater than the cost of clearing. The prices of wild lands, in Upper Canada, have undergone a very great advance, during the past three years ; but, circumstanced as this Province is, and considering its comparative small amount of population, it will not, perhaps, be taking a too sanguine view, if we anticipate, that we shall, in a year or two, approach the prices now paid in the State of New York, for lands in this section of the Province enjoying an equally fertile soil, and having the like facilities of railroad and water communications.

" It has been well observed by Professor Johnston in a recent article of the *Journal of the Royal Agricultural Society of England*, on the relations of Geology to Agriculture in North America, that the *Peninsula* of Upper Canada, encircled by Lakes Ontario, Erie, and Huron, has a much wider expansion of those happily combined soils, which are so eminently distinguished for the growth of the finest quality

of Wheat, in large abundance, than even the far-famed Genesee District of the neighbouring State of New York.

"In this extensive range of country, (bounded by the great Lakes,) there is absolutely no land that is naturally sterile; and, probably, there is no other tract of equal area on the North American Continent, so well adapted, from circumstances of soil and climate, to the general purposes of Agriculture. This interesting region has already been materially benefited by the opening of the Great Western, and the Ontario, Simcoe, and Huron Railways; and is rapidly settling by a persevering and industrious class of people. It will in a few years be the Garden of Canada, if not of North America."

LITERARY AND HISTORICAL SOCIETY OF QUEBEC.

LITERARY OR STATED MEETING.

WEDNESDAY, 4TH APRIL, 1855.

The following gentlemen were proposed as Associate Members, viz: Charles Walker, and Hammond Gowan.

A Paper was read by Lieut. E. Ashe, R.N., F.R.A.S, "On the Connection between Astronomy and Navigation."

The thanks of the Society were ordered to be given to Lieut. Ashe for his paper, which was referred to the Class of Science.

Mr. A. R. Roche's Paper on "Russian America" was recommended for publication by the Class of Literature.

MONTHLY GENERAL MEETING.

11TH APRIL, 1855.

The following gentlemen were elected members:—

The Hon. John A. Macdonald, Attorney-General for Upper Canada; F. T. Roche; George Desbarats; Charles Walker; Hammond Gowan; Walter Sericold, late Captain 66th Regiment; William Chessell.

As Corresponding Member:—T. E. Campbell, C.B., late Major 7th Hussars.

STATED OR LITERARY MEETING.

WEDNESDAY, 25TH APRIL, 1855.

(Wednesday, the 18th April, being the day of Humiliation, the meeting was adjourned to the following Wednesday, 25th April.)

A Paper was read by Mr. F. N. Boxer, giving a description of the River Saguenay, Lake St. John's, and surrounding country.

The thanks of the Society were ordered to be given to Mr. Boxer for his paper, which was referred to the Class of Literature.

HENRY E. STEELE,
Recording Secretary.

Notices of Books.

Journal and Transactions of the Board of Agriculture of Upper Canada. No. I. Vol. I.—April, 1855.

We most cordially welcome the appearance of the First Number of the "Transactions of the Agricultural Association and Board of Agriculture of Upper Canada." It has long been an undeserved reproach to the industry and intelligence of this magnificent farming country that no effort has hitherto been made to furnish the public with an official record of the progress of our Agricultural industry, and the efforts which have been made for many years past by the Government, by Societies, and by individuals, to encourage farming enterprize and elevate the standard of Canadian Husbandry.

The "Journal of the Board of Agriculture" will supply this want, and if we may judge from the appearance and contents of the number before us, a very important and valuable aid to the Scientific and Practical Farmer, has commenced its career.

The present number contains a brief sketch of the rise and progress of county and township Agricultural Societies, together with a notice of the various Provincial enactments which have modified the organization of such Societies up to the time of the Institution of the Board of Agriculture. The organization of the Agricultural Association of Upper Canada is described; and a sketch given of the operations of the Association as connected with Annual Provincial Exhibitions, &c., up to the year 1850. It is proposed, in the second number of the Journal, to continue the account of the proceedings of the Association, and to publish the records of the Organization and Transactions of the Board of Agriculture, as well as the Prize Essays and County Reports to which premiums have been awarded by the Board.

The Canadian Literary News Letter and Booksellers' Advertizer; H. Ramsay, Montreal, and A. H. Armour & Co., Toronto.

It is a very encouraging proof of the progress of Literature in Canada, that the present demand for new works issued in the United Kingdom and the United States, should warrant the publication of the "*Canadian Literary News Letter.*"

Even were the project seemingly one of doubtful commercial advantage to the publishers, it would still be gratifying to know that it gave promise of future success. We note, therefore, with much cordiality the progress which has been made during the short period of five months in the issues of the *Literary News Letter*. In the first number we were promised a circulation of 2,500 copies monthly, in the May number (fifth) we find that 3000 copies are circulated throughout the Province and 500 addressed to the leading Booksellers and Publishers in the United States and Great Britain. We hope this rapid increase will prove as advantageous to the publishers as it is to the Canadian Public.

It may happen that some of our readers are not familiar with the design and object of the "*Literary News Letter*:" we shall therefore endeavour to give a brief account of the contents of the May number.

The inducements held out to the publishers by the frequent applications made to the Colonial Trade generally for the prices, sizes, and standing of new works issued in Great Britain and the United States, were sufficient to lead them to establish such a medium as would satisfy to the full, the demand continually made upon them. One Division of the *Literary News Letter* is devoted to editorial reviews of new books and periodicals. A second Division furnishes a monthly list of the books published in the United Kingdom, and is partly occupied by reviews of the works named, from the London Athenæum, the London Literary List (Bents) &c., &c. A third Division refers more particularly to the United States—and besides giving a list of the new publications, furnishes also brief reviews from Norton's Literary Gazette, (N. Y.) &c., &c. Then follow Literary Notices, Miscellaneous Announcements, and a large number of Publisher's advertisements.

The "*Literary News Letter*" will prove a valuable and acceptable monthly gift to the Canadian Public.

Rice Lake Bridge.

In the present number of the Journal we publish a very interesting description of the Rice Lake Railway Bridge. The cost of the structure has already been enormous, yet it is far from being entirely serviceable or safe. It is doubtless an experiment much too costly for the people of Cobourg, and should never have been hazarded. We have no hesitation in saying, although somewhat in opposition to the last paragraph of Mr. Clarke's paper, that whether viewed in its mechanical construction or design, its location, or even its necessity, a greater engineering or commercial blunder can scarcely be found in the Canadas, or one which reflects less credit on the judgment of all concerned. The public are largely indebted to Mr. Clarke for collecting the facts, and for observing and recording the effects of ice during the past winter.

The Provincial Observatory.

We see, by the *Gazette*, that a Chair of Meteorology has been established in University College, Toronto. Professor Cherriman, who lately occupied the Chair of Natural Philosophy, has been appointed to tho new Chair of Meteorology. The Rev. J. W. Kingstone, of Quebec, is the new Professor of Natural Philosophy in University College.

Terrestrial Magnetism.*

As early as 1825, Col. Sabine had inferred that an influence was exerted by the sun and moon on terrestrial magnetism. In a set of observations taken at the winter station of one of the Polar Expeditions where the declination was about 90°, and discussed by him, it was remarked: that when the Sun and Moon were on the meridian at the same time, the diurnal variation reached 5°; but that when they were at right angles to each other this quantity fell as low as 20′. The sagacity he exhibited in his inference from this isolated set of observations has been sustained by the laborious and patient observations and discussions of fifteen years. Some quantities so minute are developed in the researches, that a less time would hardly have served to separate them from the larger quantities in which they are involved. The results set forth by Col. Sabine are as follows:

1. The diurnal variation, following in all places the order of solar time, and being at its maximum about two hours after noon, changes its sign at the time of the two equinoxes. Thus, while the maximum diurnal deflection from the magnetic meridian is eastward in all places up to the 21st March, a change on the amount of deviation begins on the 22d, and is completed in about ten days, after which the maximum daily variation is to the westward, and at a mean equal to the eastern variation of the preceding six months.

2. There is an annual variation in the intensity of terrestrial magnetism, of small amount indeed, but affecting both the northern and southern hemisphere in the same manner, the intensity being greatest when the sun is in perigee, and least when it is in apogee.

3. It being well known that all the instruments in magnetic observation are from time to time affected by disturbances, or *storms* as they are often called, these disturbances have been found to be subject to a periodic fluctuation. This period has been discovered to correspond with that assigned by Schabe to the spots on the solar disc.

4. It has been clearly shown that there is a variation in magnetic declination dependent on the change of the moon's position in relation to the meridian of the place of observation, and having, therefore, for its period the lunar day. This although first inferred by Sabine from a single set of observations, was fully proved by Kriel from observations made in the Austrian States before the publication of the paper of which we are stating the substance.

Finally, the hypothesis which ascribes the variations in the phenomena of terrestrial magnetism to local variations of temperature is completely refuted.

May we not hope, that the relations of the magnetism of the earth to the two heavenly bodies which exert the greatest influence in other respects upon our planet, having beeu thus conclusively shown, a basis is now provided upon which to erect a science that will be as simple in its laws, and as fertile in its results as the theory of universal gravitation? Up to the present time, terrestrial magnetism as a science has had no other foundation than vague and unsupported hypotheses, or empiric propositions, which although true, have been founded on no general law. Henceforth it would appear to be as closely within the reach of mathematical methods as the tides.

Miscellaneous Intelligence.

Mode of Measuring the Force, &c., of Earthquakes.—Dr. Kreil (former director of the Observatory at Prague) has invented an ingenious instrument to measure the force, duration, and direction of earthquakes. It consists of a pendulum so contrived that, whilst it can move in any direction, it cannot return. A perpendicular cylinder is attached, which, by means of clockwork, turns on its vertical axis in 24 hours. A pole with a thin elastic arm is fixed near the pendulum; this arm points towards the cylinder, and presses on it gently a pencil, by which means an unbroken line is formed on the surface of the cylinder as long as the pendulum is at rest, but, if it is put in motion by an earthquake, the pencil makes broken marks, which shows the strength, direction, and period of the earthquake.

* Communicated to the American Journal of Science,—May, 1855.

The Reported Death of Dr. Barth.—The following is an extract of a letter from Malta, dated the 26th of March:—"A highly interesting letter from Colonel Herman, Her Majesty's Consul at Tripoli, has reached the island, dated tho 13th of March. It says:—'You will, I am confident, be delighted to hear that the rumour of Dr. Barth's death was unfounded. A letter from him, dated Kano, the 15th of November last, reached me yesterday. He then calculated on arriving at Moorzouk within three months, but which, as he purposed moving by the circuitous route of Kooka, he never would accomplish. The rumour of his death was fabricated by the ex-ruler of Bornou for the purpose of possessing himself of a depôt of supplies that had been formed at Zejhan against the doctor's return, and in which he succeeded. The overthrow of this man was most fortunate, otherwise the fabricated report might have been converted into a stern reality.'"

Museum of Practical Geology.—In the House of Commons, Sir S. Northcote has enquired whether it was intended to fill up the vacancy created by the death of Sir H. De la Beche in the Museum of Practical Geology?—Lord Palmerston replied, that the lamented death of Sir H. De la Beche was felt, not only by that particular institution over which he presided, but by science generally. It was intended to fill up the vacancy by the appointment of Sir R. I. Murchison, in whose favour a memorial has been presented, which was signed by almost every name connected with the object for which that institution had been founded. The sum of £800 per annum has been attached to this appointment.

A Letter from Dr. Vogel to Consul Herman, dated Kaka, September 15, 1854, was read before the Geographical Society, April 30th 1855, announcing his returning from Mandara without having heard of the Chadda Expedition, which was navigating that river from August 7 to October 20, and has since safely arrived here. Dr. Vogel intended to proceed to the Chadda river by way of Jacoba, but he was compelled to turn back at Mandara, by the chief of that country. His future progress is intended to be directed towards Lake Fitri, and the eastern side of Lake Chad; but in the event of obstacles being insurmountable, he purposes to direct his steps to the Niger, by way of Nyffi, and descend that river on his way to Europe. Also a letter from Dr. Barth to Vice-Consul Gagliaffi, dated Kano, November 12, 1854, communicated by the Foreign Office. Dr. Barth disclaimed all desire of having his tomb prepared for him, as had been done by Dr. Vogel; on the contrary, he hoped, within three months, to be in Mursuk, on his return to Europe.

Dr. George Wilson, of Edinburgh, has been appointed Director of the Industrial Museum of Scotland. The museum is to be erected in the immediate vicinity of the University of Edinburgh. The ground has been purchased by Government.

The English papers announce the death of Mrs. Nichol, formerly Miss Bronte, who, under the *nom de plume* of Currer Bell, established a lasting reputation by the publication of *Jane Eyre*. We have two other novels from her pen, *Shirley* and *Vilette*, and all are especially distinguished for great power of conception and vigorous portrayal of character. The unfortunate lady, who was the last survivor of a family of six, died, at her father's house at Haworth, Yorkshire.

M. Braconnot, the discoverer of Xiloidine, Pyrogallic acid, Esquisetic Acid, Leucine, Populine, ect., the author of the transformation of Wood into Sugar, died at an advanced age at Nancy in the department of Meurthe on the 13th Jan., 1855, where he was established and where nearly all his labours had been performed.

Joseph Remy, who gave to humanity a new branch of useful industry well named, pisciculture, died at the village of La Bresse, in the Department of the Vosges, at the age of 51. His son has been charged by the Minister of Agriculture to re-people the Loire.

The dimensions of the Sault St. Mary Canal are as follows:—Its length is one mile and an eighth, its width 70 feet, depth 12 feet, and it is of sufficient capacity to admit steamboats of 2000 tons.

Herr R. Luther, of the observatory of Bilk near Düsseldorf, discovered a new asteroid planet of the eleventh magnitude, on the 19th of April. The new planet is to be named Leukothea. Its distinctive sign will be an ancient light-tower.

Errata.—Page 253, line 12, col. 1, for "Huron," read "Ontario." Same page, bottom line, read—"un ossiliferous."

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—April, 1855.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude*, 79 *deg* 21. *min. West.* *Elevation above Lake Ontario*, 108 *feet.*

Day.	Barom. at temp. of 32 deg.				Temp. of the Air.				Mean Temp. + or — of the Average	Tension of Vapour.				Humid'y of Air.				Wind.				Rain in Inch.	Snow in Inch.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.		6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.	Mean Vel'y		
					°	°	°	°	°														
1	29.256	29·263	—	—	25·5	26·2	—	—	—	0·102	0·113	—	—	·73	·78	—	—	NWbW	NWbW	N W	26·40	...	0·1
2	·412	·469	29·636	29·529	12·2	30·7	21·9	22·1	—14·5	·053	·075	0·097	0·076	65	43	·81	·63	NWbW	NWbW	NWbW	22·10	...	...
3	·822	·904	·874	·875	18·4	37·0	27·4	27·6	— 9·4	·071	·143	·127	·112	67	65	84	72	N N W	S	Calm.	3·90	...	...
4	·918	·894	·822	.872	25·5	44·5	29·8	33·3	— 4·1	·104	·128	·148	·132	74	44	89	71	Calm	S b E	Calm.	1·48	...	...
5	-674	·503	·317	·483	32·3	46·0	36·0	38·1	+ 0·4	·170	·173	·194	·182	94	57	92	81	E b S	E S E	N	3·03	...	...
6	·233	·345	—	—	32·9	42·3	—	—	—	·173	·192	—	—	93	72	—	—	N N W	N W	NWbN	12·25	Inap.	...
7	·580	·526	·433	·508	24·4	40·2	31·6	32·1	— 6·3	·113	·123	·144	·131	84	50	80	73	N b E	S S E	S W b S	5·16	...	...
8	·379	·306	—	—	34·8	54·3	—	—	—	·176	·185	—	—	88	45	—	—	Calm	S W b S	NWbN	8·83	0·035	...
9	·507	·516	·536	·517	32·9	53·2	39·1	42·6	+ 3·6	·176	·177	·214	·197	95	44	91	77	S S W	W	Calm.	6·95	0·015	...
10	·451	·489	·569	·506	36·2	40·8	32·3	36·2	— 3·3	·199	·138	·156	·163	94	55	86	79	S b W	W N W	Calm.	14·53	...	1·4
11	·668	·800	·913	·808	32·6	43·6	36·6	37·5	— 2·3	·152	·137	·189	·160	82	49	87	74	NWbN	N N W	N N W	21·09	...	...
12	·963	·906	·882	·914	33·0	51·2	37·6	40·4	+ 0·2	·148	·109	·182	·146	78	29	81	62	N N W	NWbN	N b W	7·98	...	0·1
13	·813	·726	·586	·687	36·0	36·3	35·5	36·7	— 3·7	·186	·169	·177	·181	88	79	86	84	NWbN	E	N E	4·88	0·655	...
14	·387	·345	·582	·442	38·1	60·5	41·6	47·3	+ 6·6	·220	·375	·228	·242	96	72	87	78	Calm	S S W	N N W	7·01	...	...
15	·656	·654	—	—	33·5	50·6	—	—	—	·158	·224	—	—	82	61	—	—	NWbN	S	Calm.	1·99	...	...
16	·761	·749	·746	·751	31·2	62·0	38·8	45·6	+ 4·1	·149	·312	·180	·221	84	57	77	72	Calm	S b E	Calm.	2·17	...	...
17	·659	·528	·625	·591	40·6	59·8	47·6	50·5	+ 8·8	·224	·264	·287	·265	89	52	89	75	S E	E S E	Calm.	1·78	0·095	...
18	·552	·441	·457	·473	51·3	62·9	47·0	53·6	+11·5	·350	·400	·273	·349	94	71	86	86	E b N	Calm	E S E	4·27	0·025	...
19	·443	·472	·485	·467	51·7	62·8	49·5	55·0	+12·7	·339	·333	·312	·336	90	60	89	80	Calm	N b E	Calm.	1·74	Inap.	...
20	·467	·623	·786	·639	45·2	60·9	43·4	49·0	+ 6·2	·279	·283	·184	·247	93	54	67	73	N	S b W	Calm.	4·94	...	...
21	·814	·729	·601	·707	35·0	63·0	46·3	48·3	+ 5·2	·166	·280	·266	·233	82	51	86	71	Calm	S E	Calm.	1·27	...	...
22	·563	·662	—	—	44·2	61·5	—	—	—	·238	·226	—	—	83	42	—	—	Calm	N b W	N b W	9·29	...	...
23	·811	·754	·704	·757	38·1	62·1	44·2	49·7	+ 6·0	·166	·299	·238	·239	72	55	84	68	Calm	S F	Calm.	0·61	...	...
24	·655	·478	·482	·537	40·4	63·8	58·0	55·0	+11·0	·221	·325	·338	·301	89	56	72	71	Calm	E S E	W S W	3·60	...	...
25	·704	·765	·674	·713	45·9	48·5	43·4	45·8	+ 1·4	·276	·296	·255	·269	90	88	92	88	N b W	E b N	E b N	6·54	0·695	...
26	·371	·524	·861	·596	44·5	51·6	39·2	45·4	+ 0·7	·274	·226	·180	·228	94	60	75	76	Calm	NWbN	W N W	14·43	...	...
27	·939	·914	·990	·950	36·7	53·3	35·5	42·7	— 2·3	·152	·082	·127	·135	71	19	62	52	W b S	N W	N b W	11·29	...	...
28	·988	·942	·809	·903	35·5	40·0	34·5	37·0	— 8·4	·180	·112	·157	·158	87	45	78	73	Calm	E	E	8·11	Inap.	...
29	·717	·683	—	—	36·3	39·6	—	—	—	·198	·211	—	—	93	88	—	—	E b N	E	E b N	6·65	0·440	...
30	·567	·415	·449	·470	40·2	54·1	48·6	47 0	+ 0·9	·235	·317	·300	·286	95	78	89	89	E b N	E S E	Calm	2·79	0·070	...
M	29·664	29·642	29·659	29·654	35·7	51·2	39·4	42·4	+ 1·4	0·192	0·220	0·206	0·208.	·85	·56	·83	·75	6·11	10·78	5·25	7·57	2·0	1·6

Highest Barometer...... 29·998, at 8 a.m. on 28th } Monthly range:
Lowest Barometer....... 29·233, at 6 a.m. on 6th } 0·765 inches.
Highest registered temperature 69°·4, at p.m., 14th } Monthly range:
Lowest registered temperature 10°·7, at a.m. on 2nd } 58°·7.
Mean Maximum Thermometer.............. 52°·93 } Mean daily range:
Mean Minimum Thermometer............. 32°·06 } 20.87
Greatest daily range.........37°·2, from p.m. of 14th to a.m. of 15th.
Least daily range .... 5°·7, from p.m. of 29th, to a.m. of 30th.
Warmest day....... 19th. Mean temperature......55°·02 } Difference,
Coldest day......... 2nd. Mean temperature......22°·10 } 32°·92.
Greatest intensity of Solar Radiation, 81°·5 on p.m. of 21st } Range,
Lowest point of Terrestrial Radiation, 8°·6 on a. m. of 2nd } 72°·9.
Aurora observed on 9 nights: viz. 4th, 7th, 9th, 11th, 12th, 14th, 15th, 20th and 22nd.
Possible to see Aurora on 19 nights. Impossible on 11 nights.
Raining on 8 days. Raining 23·0 hours; depth, 2·030 inches.
Snowing on 3 days. Snowing 8·0 hours; depth 1·6 inches.
Mean of Cloudiness, 0·51.
Halos were observed round the moon on the 3rd at midnight and 21st at 10 p.m.
Thunder storms occurred on the 14th, 17th, 18th, 19th and 29th.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North—2937·92 West—2581·36 South.—624·56 East—875·65.
Mean direction of the Wind, N 36° W.
Mean velocity of the Wind, 7·57 miles per hour.
Maximum velocity, 40·0 miles per hour, from 11 a.m. to noon on 26th.
Most windy day, the 1st; mean velocity, 26·40 miles per hour.
Least windy day, the 23rd; mean velocity, 0·61 " "
Most windy hour, 1 p.m.; Mean velocity, 11·76 miles per hour.
Least windy hour, 5 a.m.; Mean velocity, 4·35 miles per hour.
Mean diurnal variation, 7·41 miles.
1st. The most windy day yet recorded at the Observatory.
4th. Robins seen. 7th. Blue birds seen.
8th. Butterflies numerous. 9th. Frogs first heard.
13th. Swallows observed. 14th. First thunder storm of the season.
16th. Ice totally gone from Toronto Bay.
18th. Violent thunder storm and hurricane from 5-30 to 6-30 a.m. during which the wind for 10 min. (5-55 to 6-05 a.m) fully attained the velocity of 38 miles per hour. Heavy rain and large hailstones fell during the storm. (For details see *Canadian Journal.*
21st. In digging on the north side of the tower at the Observatory the ground was found frozen to the depth of 2 feet 9 inches.
27th. 5-30 a.m. ice ¼ inch thick on small ponds and pools.

Comparative Table for April.

Year.	Temperature.					Rain.		Snow.		Wind Mean Velocity.	
	Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	D's.	Inch.	D's.	Inch.		
1840	42·4	+1·1	65·9	25·3	40·6	14	3·420	2	...	...	
1841	39·2	—2·1	62·9	22·1	40·8	3	1·370	3	...	0·51	lb.
1842	43·1	+1·8	89·5	21·6	67·9	8	3·740	2	...	0·57	lb.
1843	40·9	—0·4	70·0	15·1	54·9	7	3·185	3	0·1	0·46	lb.
1844	47·5	+6·2	74·5	17·2	57·3	10	1·515	1	Inap.	0·24	lb.
1845	42·1	+0·8	66·0	14·8	51·2	11	3·290	4	1·5	1·00	lb.
1846	44·0	+2·7	79·4	24·4	55·0	10	1·300	2	1·3	0·55	lb.
1847	39·2	—2·1	65·6	8·4	57·2	8	2·870	2	4·0	0·59	lb.
1848	41·3	0·0	65·4	26·5	38·9	5	1·455	1	0·5	4·89	Miles.
1849	39·0	—2·3	70·9	23·2	47·7	10	2·655	2	1·7	7·50	Miles.
1850	37·9	—3·4	63·2	18·2	45·0	7	4·720	2	1·1	7·64	Miles.
1851	41·3	0·0	59·2	25 8	33·4	11	2·295	3	1·2	8·07	Miles.
1852	38·2	—3·1	53·8	19·8	34·0	6	1·990	4	9·4	6·68	Miles.
1853	41·9	+0·6	65·7	27·0	38·7	10	2·625	1	1·0	5·20	Miles.
1854	41·0	—0·3	65·1	22·3	42·8	12	2·685	4	2·7	6·82	Miles.
1855	42·4	+1·1	63·8	12·2	51·6	8	2·030	3	1·6	7·57	Miles.
										0·56	lbs.
M'n.	41·34		67·55	20·24	47·31	8·7	2·571	2·4	2·0	6·80	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—April, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inch.	Snow in Inch.	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.			6 A.M.	2 P.M.	10 P.M.
1	29·249	29·482	29·186	30·1	33·0	11·7	·160	·171	·085	·86	·83	·88	N E b E	N W	N W	1·25	8·74	25·00	...	...	Clear.	Str. 10.	Str. 10.
2	·043	·189	·441	5·7	15·4	24·1	062	092	097	80	83	65	W N W	W N W	N W b N	32·97	21·98	15·54	...	3·14	Snow.	Snow.	Do. 10.
3	·841	·901	30·091	9·0	32·5	25·3	062	161	123	84	78	80	N W b W	W b N	W b S	19·20	13·53	7·50	...	...	Clear.	Clear.	Cum. Str. 6.
4	30·111	30·141	30·110	25·0	45·9	37·5	141	282	218	90	86	91	W	W	W	6·28	0·56	0·59	...	...	Do.	Do.	Str. 10.
5	30·034	29·879	29·650	36·4	47·0	35·7	192	220	192	83	66	83	W S W	E b N	E N E	0·09	1·04	1·68	...	...	Cum. Str. 10.	Do.	Cum. Str. 10.
6	29·450	·434	·630	32·4	46·0	27·1	178	253	157	88	76	82	N E b E	W	N W	11·37	0·47	14·51	Inap.	Inap.	Do. 10.	Rain.	Clear.
7	·731	·700	·716	17·0	37·5	26·2	096	207	108	83	84	66	N W	W S W	W b S	8·10	10·33	8·75	...	...	Clear.	Clear	Do.
8	·710	·691	·681	27·0	44·4	39·2	119	241	199	71	79	79	S W	S S W	S S W	11·58	4·57	4·06	...	...	Do.	Str. 10.	Cum. Str. 8.
9	·580	·836	·880	35·6	49·0	31·8	210	281	191	91	76	95	S W b W	S S W	W b S	2·26	1·62	1·12	...	...	Str. 10.	Clear.	Cl'rAuro.Bor.
10	·850	·789	·788	34·0	39·6	33·6	182	210	210	84	79	99	E S E	E S E	S W b W	0·23	1·50	0·07	0·500	...	Cum. Str. 8.	Rain.	Rain.
11	·801	·896	·899	33·5	38·0	36·6	186	207	199	87	84	88	E b N	N E	E b N	0·37	14·76	9·75	1·136	1·20	Snow.	Rain.	Cum. Str. 10.
12	·945	·980	·998	33·2	47·4	37·8	178	282	182	86	74	77	N	N N W	N b W	9·64	8·33	10·11	...	...	Clear.	Clear.	Cl'rAuro.Bor.
13	30·043	30·081	·890	28·0	44·0	33·9	153	241	186	88	79	87	N b W	N b W	W	0·15	0·16	Calm	...	...	Do.	Cir. Cum. 4.	Do.
14	29·770	29·611	·660	34·1	39·8	36·2	204	233	212	95	90	94	E N E	S	S S E	0·62	1·55	Calm	0·166	...	Cir. Str. 10.	Rain.	Cum. Str. 9.
15	·800	·891	·800	·33·6	52·6	39·2	214	326	233	99	81	90	W	S W b S	S W b W	1·07	2·20	0·72	...	...	Clear.	Clear.	Cl'rAuro.Bor.
16	·969	30·070	30·060	34·4	58·6	46·1	212	367	209	99	73	74	W b S	S W b W	S W b W	4·62	8·03	Calm	...	...	Do.	Do.	Do.
17	·990	29·950	29·946	35·7	71·6	47·7	210	414	291	71	55	86	S S W	W S W	W N W	2·37	1·50	1·17	Inap.	...	Do.	Cir. Cum. Str. 4.	Str. 10.
18	30·000	·810	·740	41·0	47·1	40·0	210	271	210	74	79	79	N E b E	N E b E	N E b E	2·54	5·00	9·51	0·296	...	Str. 10.	Cir. Str. 10.	Cum.Str.10 h.
19	29·742	·800	·889	36·7	44·3	40·6	218	223	227	91	73	83	N E	N E	N E b E	Calm	6·94	2·17	...	...	Cum. Str. 10.	Do. 8.	Str. 10.
20	·811	·860	·960	30·1	46·6	40·1	178	243	227	86	74	85	N E	N E b N	S	2·16	1·02	Inap.	...	...	Str. 10.	Cir.Cum.Str.8	Clear.
21	·990	30·081	30·000	36·6	63·2	49·2	174	307	251	77	53	70	S W b W	S W b W	W b S	0·89	6·35	5·07	...	...	Clear.	Clear.	Do.
22	·881	29·892	30·091	44·1	55·7	43·6	223	372	201	83	78	81	S W b W	S W b W	N	0·25	2·92	6·92	0·140	...	Do.	Str. 10.	Do.
23	30·141	30·089	29·943	30·6	61·0	54·3	160	352	283	86	60	69	N	S S W	W S W	1·11	1·65	6·99	...	...	Do.	Light Cirr.	Cum. Str. 8.
24	29·884	29·880	·852	49·9	70·8	51·2	270	421	300	72	57	78	W S W	W b S	N E	3·62	2·92	1·95	Inap.	...	Do.	Clear.	Do. 10.
25	·947	30·111	30·161	40·0	57·3	43·0	218	398	252	85	84	85	N E b N	N E b N	E	18·12	3·75	5·69	...	...	Cum. Str. 10.	Do.	Clear.
26	·731	29·400	29·849	40 6	51·7	41·1	245	337	217	92	87	88	S S E	S b E	W N W	36·50	49·64	15·27	1·040	...	Rain.	Cir. Str. 8.	Cum. 4.
27	·861	30·042	30·105	34·6	40·6	34·9	195	179	136	91	68	87	W	W N W	W N W	26·48	24·27	21·25	...	Inap.	Cum. Str. 8.	Cir. 2.	Clear.
28	30·201	30·190	30·189	28·0	43·0	33·7	135	377	153	75	52	74	N W	W N W	N W b N	16·22	7·87	4·64	...	...	Clear.	Clear.	Do.
29	30·214	30·121	29·949	33·5	55·8	41·7	187	351	253	89	79	91	N E b E	E S E	S E b S	1·12	5·04	7·78	...	...	Do.	Do.	Str. 10.
30	29·731	29·892	·732	42·5	65·0	48·2	272	306	302	92	49	86	S S E	S b E	S b E	0·87	3·75	1·37	0·916	...	Rain.	Str. 10.	Do.

Barometer ....
- Highest, the 29th day .... 30·214
- Lowest, the 2nd day .... 29·043
- Monthly Mean .... 29·849
- " Range .... 1·171

Thermometer
- Highest, the 17th day .... 76°·8
- Lowest, the 2nd day .... 5°·7
- Monthly Mean .... 40°·15
- " Range .... 71°·1
- Mean Humidity .... ·808

Greatest Intensity of the Sun's Rays .... 89°·9

Amount of Evaporation in inches .... 1·70 in.

Rain fell on 10 days, accompanied by thunder on 1 day, amounting to 4,194 inches, raining 41 h. 20 min.

Snow fell on 4 days, amounting to 4,34 inches. Snowing 17 hours 40 minutes.

Most prevalent Wind, W. Least prevalent Wind, N.

Most Windy Day, the 26th day; mean miles per hour, 33·80.

Least Windy Day, the 13th day; mean miles per hour, 0.10.

Aurora Borealis visible on 3 nights. Might have been seen on 10 nights.

The electrical state of the atmosphere has been marked generally by high tension; and during the thunder storm of the 18th day indicated a very high tension of a negative character.

The *Rossignol*, the harbinger of the spring in Lower Canada, 1st seen on 9th day.

Swallows first seen on the 14th day. Frogs first heard on the 24th day.

Crossing on the ice at Montreal ceased on the 22nd.

Ozone.—The amount of Ozone on the atmosphere was less during the month than usual.

Monthly Meteorological Register, Quebec, Canada East, April, 1855.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	10 P.M.	2 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·248	28·909	28·621	29·926	29·9	32·8	16·3	26·3	0·160	0·173	0·092	0·142	96	93	95	95	E	E N E	W b S	19·7	16·0	17·9	...	6·0	
2	28·646	·744	29·109	·833	5·9	14·9	18·7	13·2	·062	·085	·083	·077	100	93	78	90	W b N	W b N	W b N	19·7	34·0	21·3	...	8·0	
3	29·446	29·699	·854	29·666	13·6	28·1	24·7	22·1	·065	·094	·101	·087	76	62	73	70	N W	W	Calm.	22·7	10·0	0·0	...	...	
4	·912	·818	·883	·871	17·8	39·2	33·6	30·2	·085	·109	·107	·100	83	45	56	61	S W	NWbW	Calm.	3·8	6·2	0·0	...	...	4th. Aurora at 9 p.m., and Auroral light at 10 p.m.
5	·859	·737	·554	·717	29·8	42·9	31·0	34·6	·130	·157	·154	·147	78	57	89	75	Calm.	E N E	E N E	0·0	12·4	21·6	...	...	
6	·313	·184	·297	·265	29·1	35·9	29·5	31·5	·141	·156	·112	·136	88	74	69	77	E N E	N W	N W	27·8	8·0	18·3	0·204	...	6th. Aurora observed at midnight.
7	·498	·460	·529	·496	13·5	28·6	24·1	22·1	·073	·090	·097	·087	83	57	73	71	N W	S S W	Calm.	12·4	10·0	0·0	...	...	
8	·637	·569	·720	·642	24·0	38·3	35·8	32·7	·093	·121	·139	·118	70	51	67	63	E S E	Calm.	S	2·0	0·0	3·8	...	...	
9	·629	·643	·697	·656	32·3	36·6	34·2	34·4	·160	·198	·179	·179	87	92	92	90	Calm.	Calm.	Calm.	0·0	0·0	0·0	0·066	...	9th. Aurora observed at 8 p.m. Sky overcast at 10 p.m.
10	·763	·747	·718	.743	33·8	35·2	34·1	34·4	·159	·184	·190	·178	81	90	97	89	S S W	S E b E	E N E	3·8	5·2	13·9	0·699	Inap	
11	·735	·735	·726	·732	32·6	33·5	33·3	33·1	·177	·178	·168	·175	96	94	88	93	E N E	E N E	E N E	10·0	13·9	18·3	0·132	...	
12	·726	·682	·751	·720	30·7	42·8	36·2	36·8	·147	·163	·083	·131	84	59	39	61	N E	Calm.	N N W	3·8	0·0	10·0	...	...	12th. A very fine Aurora observed.
13	·870	·842	·882	·865	25·1	30·6	28·1	27·9	078	·115	·130	·108	57	67	84	69	Calm.	E S E	Calm.	0·0	10·9	0·0	...	...	
14	·721	·436	·390	·516	26·0	38·5	35·7	33·4	·114	·140	·208	·154	79	60	100	80	N E	Calm.	S W	5·2	0·0	7·2	0·448	...	
15	·548	·591	·818	·652	33·5	43·3	33·3	38·0	·172	·151	·168	·164	91	51	76	74	Calm.	S W	S S W	0·0	6·2	2·0	...	...	
16	·680	·710	·747	·712	33·6	50·8	43·5	42·6	·165	·165	·151	·160	86	45	54	62	W b S	W N W	Calm.	5·2	6·2	0·0	...	...	
17	·747	·614	·756	·706	42·6	58·6	48·4	49·9	·174	·186	·247	·202	65	39	74	59	Calm.	N W	S S W	0·0	9·3	6·2	Inap.	...	
18	·791	·761	·589	·714	37·4	41·0	36·9	38·4	·164	·153	·128	·148	74	60	59	64	E N E	E N E	E N E	11·3	7·2	16·0	0·184	...	
19	·568	·622	·693	·628	31·8	33·1	31·7	32·2	·179	·166	·147	·161	100	88	82	90	E N E	E N E	E N E	17·9	16·0	10·9	...	...	
20	·685	·635	·756	·692	32·6	42·7	34·6	36·6	·162	·196	·187	·178	88	72	94	85	E N E	Calm.	Calm.	5·2	0·0	0·0	...	...	
21	·814	[illegible]	·747	·774	30·4	53·4	39·8	41·2	·148	·196	·163	·169	88	48	67	68	W S W	Calm.	Calm.	5·2	0·0	0·0	...	...	21st. At 11 p.m. a bright Aurora observed through a break in the clouds.
22	·643	·574	·839	·685	38·4	52·7	42·0	44·4	·184	·131	·126	·147	79	59	48	62	E	W	Calm.	2·0	8·0	0·0	0·249	...	
23	·939	·839	·660	·813	34·7	50·6	43·6	43·0	·141	·179	·170	·161	72	57	61	63	Calm.	W	Calm.	0·0	0·0	0·0	...	...	
24	·659	·654	·716	·680	42·6	55·3	33·0	45·6	·200	·196	·138	·178	74	46	58	59	W N W	S W	E S E	8·0	8·8	17·6	0·046	...	
25	·8[illegible]1	·930	30·004	·923	33·8	39·0	34·7	35·8	·171	·130	·150	·150	89	55	74	73	E	E N E	E	16·0	16·5	7	...	...	27th. At 2 p.m. very heavy gusts of wind, varying in velocity from 39 to 50 miles per hour.
26	·802	·372	....	....	35·4	35·2			·147	·201		·	73	98			E	Calm.	E	13·9	0·0		1·914	...	
27	·548	·564	29·759	·624	32·9	35·5	29·8	32·7	·109	·142	·072	·108	58	70	43	57	N W	N W	N W	27·8	22·7	21·3	...	...	
28	·936	·904	·941	·927	17·7	36·0	29·3	27·7	·052	·058	·076	·062	51	26	47	41	N N W	N W	N W	16·9	17·6	3·8	...	...	
29	30·030	·92[illegible]	·912	·956	21·8	43·6	32·7	32·7	·085	·059	·106	·083	70	21	57	49	N E	W S W	N N E	3·8	3·8	7·2	...	...	
30	29·892	·768	·735	·798	34·0	38·6	36·6	36·4	·105	·083	·191	·126	54	79	88	74	N E	E b S	E b S	8·8	9.3	5·2	0·692	...	*Note.*—At 2 p.m. of 23rd, 28th, and 29th, the observed Dew Point was respectively 18°5, —2°8, and 3°2.
—	29·666	29·623	29·669	29·6527	29·03	39·73	33·67	34·14	0·133	0·140	0·140	134	79	62	72	71				8·24	8·91	8·27	4·434	14·0	

Maximum Barometer, 6 a.m. on the 29th	30·030
Minimum Barometer, 10 p.m. on the 1st	28·621
Monthly Range	1·409
Monthly Mean	29·6527
Maximum Thermometer on the 17th	59°·8
Minimum Thermometer on the 1st	5·9
Monthly Range	53·9
Mean Maximum Thermometer	43·01
Mean Minimum Thermometer	25·91
Mean Daily Range	17·10
Mean Monthly Temperature	34·14

Greatest Daily Range of Thermometer on 1st	30°·5
Least Daily Range of Thermomter on 19th	2°·8
Warmest Day, 17th. Mean Temperature	49·9
Coldest Day, 2nd. Mean Temperature	13·2
Climatic Difference	36·7

Possible to see Aurora on 16 Nights.
Aurora visible on 16 Nights.
Total quantity of Rain, 4·434 inches.
Total quantity of Snow, 14·0 inches.
Rain fell on 11 days.
Snow fell on 3 days.

The Canadian Journal.

TORONTO, JULY, 1855.

Incidents of Travel on the North-West Coast, Vancouver's Island, Oregon, &c., &c.,

BY PAUL KANE, ESQ., TORONTO.

THE CHINOOK INDIANS.

(*Read before the Canadian Institute, March 14th.**)

As it would be impossible for me in the confined limits of a paper like the present to give anything like a detailed account of all the tribes of Indians amongst whom I have travelled, I have considered that it would prove far more interesting were I to confine myself to one tribe, and give full information regarding their habits, customs and traditions. For this purpose I have selected the Chinooks, one of the tribes among whom I have been, most remote from this part of the continent, and whose manners and customs are so much at variance with our own, as, I trust, to render some notice of them, from personal observation, novel and interesting.

The Flat-Head Indians are met with along the banks of the Columbia river from its mouth eastward to the Cascades, a distance of about 130 miles; they extend up the Walamett river south about 30 or 40 miles, and through the district lying between the Walamett and Fort Astoria, now called Fort George. To the north they extend along the Cowlitz river and the tract of land lying between that and Puget's Sound. About two-thirds of Vancouver's Island is also occupied by them, and they are found along the coasts of Puget's Sound and the Straits of Juan de Fuca. The Flat-Heads are divided into numerous tribes, each having its own peculiar locality, and differing more or less from the others in language, customs and manners.

Of these I shall select, as the subject of the present paper, the Chinooks, a tribe inhabiting the tract of country at the mouth of the Columbia river. Residing among the Flat-Heads I remained from the fall of 1846 to the following autumn of 1847, and had consequently ample opportunity of becoming acquainted with the peculiar habits and customs of the tribe. They are governed by a Chief called Casenov. This name has no translation. The Indians on the west side of the Rocky Mountains differing from those on the east, in having hereditary names, to which no particular meaning appears to be attached, and the derivation of which is in many instances forgotten. Casenov is a man of advanced age, and resides principally at Fort Vancouver, about 90 miles from the mouth of the Columbia. I made a sketch of him while staying there, and obtained the following information as to his history and previous career:—Previous to 1829 Casenov was considered a great warrior, and could lead into the field 1,000 men, but in that year the Hudson's Bay Company and emigrants from the United States introduced the plough for the first time into Oregon, and the locality hitherto considered one of the most healthy was almost depopulated by the fever and ague.

Their principal settlement, Chinook Point, where King Cumcomley ruled in 1811, at the mouth of the river, was nearly reduced to one-half its numbers. The Klatsup village now contains but a small remnant of its former inhabitants. Wasiackum, Catlamet, Kullowith, the settlements at the mouth of the Cowlitz, Kallemo, Kattlepootle and Walkumup are entirely extinct as villages. On Soveys Island there were formerly four villages but now there scarcely remains a lodge.

They died of this disease in such numbers that their bodies lay unburied on the river's banks, and many were to be met with floating down the stream.

The Hudson's Bay Company supplied them liberally with Quinine and other medicines, but their good effects were almost entirely counteracted by their mode of living, and their obstinacy in persisting in their own peculiar mode of treatment, which consisted principally in plunging into the river without reference to the particular crisis of the disease.

From these two causes their numbers have been very much reduced, and the effective power of the tribes so greatly diminished that the influence which Casenov owed to the number of his followers has correspondingly declined; his own immediate family consisting of ten wives, four children and eighteen slaves, being reduced in one year to one wife, one child and two slaves. Their decrease since that time has also been fearfully accelerated by the introduction of ardent spirits, which, in spite of prohibition and fines against selling it to Indians, they manage to obtain from their vicinity to Oregon city, where whiskey, or a poisonous compound called there *blue ruin*, is illicitly distilled. I have scarcely ever seen an Indian in that vicinity who would not get drunk if he could procure the means, and it is a matter of astonishment how very small a quantity suffices to intoxicate these unfortunate beings, although they always dilute it largely in order to prolong the pleasure they derive from drinking. Casenov is a man of more than ordinary talent for an Indian, and he has maintained his great influence over his tribe chiefly by means of the superstitious dread in which they hold him.

This influence was wielded with unflinching severity towards them, although he has ever proved himself the firm friend of the white man. Casenov for many years in the early period of his life kept a hired assassin to remove any obnoxious individual against whom he entertained personal enmity.

This bravo, whose occupation was no secret, went by the name of Casenov's *Skócoom* or evil genius. He finally fell in love with one of Casenov's wives who eloped with him; Casenov vowed vengeance, but the pair for a long time eluded his search, until one day he met her in a canoe near the mouth of the Cowlitz river and shot her on the spot. After this he lived in such continual dread of the lover's vengeance that for nearly a year he never ventured to sleep, but in the midst of a body guard of 40 armed warriors, until at last he succeeded in tracing him out, and had him assassinated by the man who had succeeded him in his old office. The Chinooks over whom Casenov presides carry the process of flattening the head to a greater extent than any other of the Flat-Head tribes.

The process is as follows:—The Indian mothers all carry their infants strapped to a piece of board covered with moss or loose fibres of cedar bark, and in order to flatten the head they place a pad on its forehead, on the top of which is laid a piece of smooth bark bound on by a leathern band passing through holes in the board on either side and kept tightly pressed across the front of the head. A sort of pillow of grass or cedar fibres being placed under the back of the neck to support it.

This process commences with the birth of the infant and is

* Various articles of dress worn by the Chinook Indians, specimens of their bows and arrows, spears, cooking utensils, and a skull taken from one of their graves, were exhibited. Several admirable oil paintings, executed by Mr. Kane, illustrated many important features of the lives and characters of the Chinook Indians. (See proceedings of the Canadian Institute, March 14th, page 243, *Canadian Journal.*)

continued for a period of from 8 to 12 months, by which time the head has lost its natural shape and acquired that of a wedge, the front of the skull becoming flat, broad and higher at the crown, giving it a most unnatural appearance.

Many people would suppose that from the extent to which this is carried the operation would be attended with great suffering to the infant, but I have never heard the infants crying or moaning, although I have seen the eyes seemingly starting out of the sockets from the great pressure. But on the contrary, when the lashings were removed I have noticed them cry until they were replaced.

From the apparent dullness of the children whilst under the pressure I should imagine that a state of torpor or insensibility is induced, and that the return to consciousness occasioned by its removal must be naturally followed by the sense of pain.

This unnatural operation does not however seem to injure the health, the mortality amongst the Flat-Head children not being perceptibly greater than amongst other Indian tribes. Nor does it seem to injure their intellect, on the contrary; the Flat-Heads are generally considered fully as intelligent as the surrounding tribes who allow their heads to preserve their natural shape; and it is from amongst the round-heads that the Flat-Heads take their slaves; looking with contempt even upon the whites for having round heads, the *flat-head* being considered as the distinguishing mark of freedom. I may here remark, that, amongst the tribes who have slaves there is always something which conspicuously marks the difference between the slave and the free, such as the Chimseyan, who wear a ring in the nose, and the Babbenes who have a large piece of wood inserted through the under lip. The Chinooks, like all other Indian tribes, pluck out the beard on its first appearance.

I would willingly give a specimen of the barbarous language of these people, were it possible to represent by any combination of the letters of our alphabet the horrible harsh spluttering sounds which proceed from their throats, apparently unguided either by the tongue or lips.

It is so difficult to acquire a mastery of their language that none have been able to attain it unless those who have been born amongst them.

They have, however, by their intercourse with the English and French traders succeeded in amalgamating, after a fashion, some words of each of these tongues with their own and formed a sort of Patois, barbarous enough certainly, but still sufficient to enable them to communicate with the traders.

This Patois I was enabled, after some short time, to acquire, and could converse with most of the chiefs with tolerable ease. There common salutation is *Clah hoh ah yah*, originating, as I believe, in their having heard in the early days of the fur trade a gentleman named Clark frequently addressed by his friends, "Clark, how are you?" This salutation is now applied to every white man, their own language affording no appropriate expression.

Their language is also peculiar in containing no oaths, or any words conveying gratitude or thanks.

Their habits are extremely filthy, their persons abounding with vermin, and one of their chief amusements consists in picking these disgusting insects from each others' heads and eating them. On my asking an Indian one day why he ate them, he replied that they bit him and he gratified his revenge by biting them in return. It will naturally be supposed that they are thus beset from want of combs or other means of displacing the intruders; but this is not the case, they pride themselves on carrying such companions about them, and giving their friends the opportunity of amusing themselves in hunting and eating them.

The costume of the men consists of a musk-rat skin robe, the size of one of our ordinary blankets, thrown over the shoulders, without any breach-cloth, moccassins or leggings.

Painting the face is not much practised amongst them except on extraordinary occasions, such as the death of a relative, some solemn feast, or going on a war party.

The female dress consists of a girdle of cedar bark round the waist, with a dense mass of strings of the same material hanging from it all around and reaching almost to the knees. This is their sole summer habiliment.

They, however, in very severe weather add the musk-rat blanket. They also make another description of blanket from the skin of the wild goose, which is here taken in great abundance. The skin is stripped from the bird with the feathers on and cut into strips, which they twist so as to have the feathers outwards. This makes a feathered cord, and is then netted together so as to form a blanket, the feathers filling up the meshes, rendering it a light and very warm covering.

In the summer these are entirely thrown aside, not being in any case worn from feelings of delicacy.

The men go quite naked, though the women always wear the cedar petticoat. The country which the Chinooks inhabit being almost destitute of furs they have little to trade in with the whites.

This, coupled with their laziness—probably induced by the ease with which they procure fish, which is their chief subsistence—prevents their obtaining ornaments of European manufacture, consequently anything of the kind is seldom seen amongst them. They, however, wear long strings of small shells found on the coast called Ioquas, and used by them also as money.

A great traffic is carried on amongst all the tribes through the medium of these shells. They are fished up from the bottom of the sea, and are from an inch and a-half to two inches in length; they are white, slender, hollow and tapering to a point, slightly curved and about the size of the stem of an ordinary clay tobacco pipe. They are valuable in proportion to their length, and their value increases according to a fixed ratio, forty shells being the standard number required to extend a fathoms' length, which number is in that case equal in value to a beaver's skin, but if 39 be found long enough to make the fathom it would be worth 2 beaver skins, if 38 three skins, and so on, increasing one beaver skin for every shell less than the standard number.

The Chinooks evince very little taste in comparison with some of the tribes on the eastern side of the Rocky Mountains, in ornamenting either their persons or their warlike or domestic implements.

The only utensils I saw at all creditable to their decorative skill were carved bowls and spoons of horn, and baskets made of roots and grass woven so closely as to serve all the purposes of a pail in holding and carrying water.

In these they even boil the salmon which constitute their principal food. This is done by immersing the fish in one of the baskets filled with water, into which they throw red hot stones until the fish is cooked, and I have seen fish dressed as expeditiously by them in this way as if done in a kettle over a fire by our own people. The salmon is taken during the months of June and July in immense numbers in the Columbia river and its tributaries by spearing and with gill nets.

They have also a small hand net something like our common landing net, which is used in rapids where the salmon are crowded together and near the surface.

These nets are ingeniously contrived, so that when a fish is in them his own struggles loosen a little stick which keeps the mouth of the net open while empty, but which, when the net is full, immediately draws it together like a purse with the weight of the salmon and effectually secures the prey.

The salmon taken during this period of the year is split open and dried in the sun for their winter's supply. I have never seen salt made use of by any tribe of Indians for the purpose of preserving food, and they all evince the greatest dislike to salt meat.

I may here mention a curious fact respecting the salmon of the Columbia river; they have never been known to rise to a fly, although it has been frequently tried by gentlemen of the Hudson's Bay Company, with the very best tackle. The salmon go up the river as far as they possibly can and into all its tributary streams in myriads; it is, however, a well known fact that after spawning they never return to the sea, but all die in the river; the Columbia is hardly ever free from gill nets, and no salmon has ever been taken returning, and in the fall, wherever still water occurs, the whole place is tainted by their putrid bodies floating in immense masses. I have been obliged to travel through a whole night trying to find an encampment which would be free from their disgusting effluvia.

The Chinooks also catch a considerable number of sturgeon, which here attain to an enormous size, weighing from four to six cwt.; this is done by means of a long-jointed spear handle 70 or 80 feet in length, fitted into but not actually fastened to a barbed spear-head, to which is attached a line, with this they feel along the bottom of the river, where the sturgeon are found lying at the spawning season; upon feeling the fish the barbed spear is driven in and the handle withdrawn. The fish is then gradually drawn in by the line, which being very long allows the sturgeon room to waste his great strength so that he can with safety be taken into the canoe or towed ashore.

At the mouth of the river a very small fish, about the size of our Sardines, is caught in immense numbers, it is called there Uhlékun, and is much prized on account of its delicacy and extraordinary fatness. When dried this fish will burn from one end to the other with a clear steady light like a candle. The Uhlékuns are caught with astonishing rapidity by means of an instrument about 7 feet long, the handle is about 3 feet, into which is fixed a curved wooden blade about 4 feet, something the shape of a sabre, with the edge at the back. In this edge, at the distance of an inch and a-half, are inserted sharp bone teeth about an inch long, the Indian standing in the canoe draws this edgeways with both hands, holding it like a paddle, rapidly through the dense schools of fish, which are so thick that almost every tooth will strike a fish. One knock across the thwarts safely deposits them in the bottom of the canoe. This is done with such rapidity that they will not use nets for this description of fishing.

There are few whales now caught on the coast, but the Indians are most enthusiastic in the hunt. Upon a whale being seen blowing in the offing they rush down to their large canoes and push off, with 10 or 12 men in each; each canoe is furnished with a number of strong seal skin bags filled with air, and made with great care and skill, capable of containing about 10 gallons each, to each bag is attached a barbed spear-head by a strong string about 8 or 9 feet long, and in the socket of the spear-head is fitted a handle 5 or 6 feet in length. Upon coming up with the whale the barbed heads with the bags attached are driven into the whale and the handles withdrawn. The attack is continually renewed until the whale is no longer able to sink from the buoyancy of the bags, when he is despatched and towed ashore. The blubber of the whale is much prized amongst them, and is cut into stripes about 2 feet long and 4 inches wide and eaten generally by them with their dried fish.

Clams and oysters are very abundant, and seals, wild ducks and geese are taken in great plenty, but their fishing is so productive that they subsist with very little labour.

They are also very fond of herrings' roe, which they collect in the following manner:—They sink cedar branches to the bottom of the river, in shallow places, by placing upon them a few heavy stones, taking care not to cover the green foliage, as the fish prefer spawning on anything green, and they literally cover all the branches by next morning with spawn. The Indians wash this off in their water-proof baskets, to the bottom of which it sinks; this is squeezed by the hand into little balls and then dried, and is very palatable.

The only vegetables in use amongst them are the Camas and Wappattoo. The Camas is a bulbous root much resembling the onion in outward appearance but is more like the potato when cooked and is very good eating. The Wappattoo is somewhat similar but larger and not so dry or delicate in its flavour. They are found in immense quantities in the plains in the vicinity of Fort Vancouver, and in the spring of the year present a most curious and beautiful appearance, the whole surface presenting an uninterrupted sheet of bright ultramarine blue from the innumerable blossoms of these plants. They are cooked by digging a hole in the ground, then putting down a layer of hot stones, covering them with dry grass, on which the roots are placed; they are then covered with a layer of grass, and on the top of this they place earth, with a small hole perforated through the earth and grass down to the vegetables. Into this they pour water, which, reaching the hot stones, forms sufficient steam to completely cook the roots in a short time, the hole being immediately stopped up after the introduction of the water. They often adopt the same ingenious process for cooking their fish, meat, and game.

There is another article of food made use of amongst them, which from its disgusting nature I should have been tempted to omit were it not a peculiarly characteristic trait of the Chinook Indian, both from its extraordinary character, and its use being confined solely to this tribe; it is, however, regarded only as a luxury and not as a general article of food. The whites have given it the name of Chinook Olives, and it is prepared as follows:—About a bushel of acorns are placed in a hole dug for the purpose close to the entrance of the lodge or hut, and covered over with a thin layer of grass, on top of which is laid about half a foot of earth; every member of the family henceforth regards this hole as the special place of deposit for their urine, which is on no occasion to be diverted from its legitimate receptacle, even should a member of the family be sick and unable to reach it for this purpose the fluid is carefully collected and carried thither. However disgusting such an odoriferous preparation would be to people in civilized life the product is regarded by them as the greatest of all delicacies; so great indeed is the fondness they evince for this horrid preparation that even when brought amongst civilized society they still yearn after it and will go any length to obtain it. A gentleman in charge of Fort George had taken to himself a wife, a woman of this tribe, who of course partook with himself of the best food the Fort could furnish; notwithstanding which, when he returned home one day his nostrils were regaled with a stench so nauseating that he at once enquired where she had deposited the Chinook olives, as he knew that nothing else could poison the atmosphere in such a manner.

Fearful of losing her dearly-prized luxury she strenuously denied its possession: his nose however soon led him to the place of deposit, and they were soon consigned to the river. His mortification was afterwards not a little increased by learning that she had purchased the delicacy with one of his best blankets.

During the season the Chinooks are gathering Camas and fishing they live in lodges constructed by means of a few poles covered with mats made of rushes, which can be easily moved from place to place; but in the villages they build permanent huts of split cedar boards. Having selected a dry place for the village a hole is dug about three feet deep and about twenty feet square, round the sides of this square cedar boards are sunk and fastened together with cords and twisted roots, rising about four feet above the outer level; two posts are sunk at the middle of each end with a crotch at top, on which the ridge pole is laid, and boards laid from thence to the top of the upright boards. Fastened in the same manner round the interior are erected sleeping places, one above another something like the berths in a vessel, but larger. In the centre the fire is made, the smoke of which escapes from a hole left in the roof for that purpose. These lodges are filthy beyond description and swarm with vermin. The fire is procured by means of a small flat piece of dry cedar, in which a small hollow is cut with a channel for the ignited charcoal to run over; this piece the Indian sits on to hold it steady while he rapidly twirls a round stick of the same wood between the palms of his hands with the point pressed into the hollow of the flat piece. In a very short time sparks begin to fall through the channel upon finely frayed cedar bark placed underneath which they soon ignite. There is a great deal of knack in doing this, but those who are used to it will light a fire in a very short time. The men usually carry these sticks about with them, as after they have been once used they produce the fire quicker.

The only warlike implements I have seen amongst them were bows and arrows. The bows are made from the Yew tree, and the arrows are feathered and pointed with sharp bone. These they use with great precision.

Their canoes are hollowed out of the cedar, and some of them are very large, as this tree grows to an immense size in the neighbourhood. They make them very light, and from their formation they are capable of withstanding very heavy seas.

Slavery is carried to a great extent along the North-West coast and in Vancouver's Island; and the Chinooks, considering how much they themselves have been reduced, still retain a large number of slaves. These are usually procured from the Chastay tribe who live near the Umqua, a river south of the Columbia emptying into the Pacific. They are sometimes seized by war parties, but are often bought from their own people. They do not flatten the head, nor is the child of one of them (although by a Chinook father), allowed this distinguishing mark of freedom. Their slavery is of the most abject description: the Chinook men and women treat them with great severity, and exercise the power of life and death at pleasure. An instance of the manner in which the Chastay slaves are treated presented itself to my own observation one morning while I was out sketching on Vancouver's Island. I saw upon the rocks the dead body of a young woman whom I had seen a few days previously walking about in perfect health, thrown out to the vultures and crows. I mentioned it to a gentleman of the Hudson's Bay Coy., who accompanied me to the lodge she belonged to, where we found an Indian woman, her mistress, who made light of her death, and who was no doubt the cause of it. She said, a slave had no right to burial. She was furious on being told that the slave was as good as herself. "She, the daughter of a chief, no better than a slave." She then stalked out of the lodge with great dignity; the next morning she had taken down the lodge and was gone. I was also told by an eye witness, of a chief who, having erected a colossal idol of wood, sacrificed five slaves to it, barbarously murdering them at its base, and asking in a boasting tone who among them could afford to kill so many slaves. One of the slaves was a handsome girl who had lived from her infancy in his family, and begged most piteously for her life, reminding him of the care she had taken of his children and all the services she had rendered; but all her pleadings were of no avail, and the brutal wretch with his own hand plunged a knife four times into her body before she ceased her appeals for mercy. The only distinction made in her favour was that she was buried, instead of being, like her miserable companions, thrown out on the beach.

The principal amusement of the Chinooks is gambling, which is carried to great excess amongst them. You never visit the camp but you hear the eternal gambling song of "he ha, ha," accompanied by the beating of small sticks on some hollow substance. Their games do not exceed two or three, and are of a simple nature. The one most generally played consists in holding in each hand a small piece of stick the thickness of a goose quill and about an inch and a-half in length, one plain and the other distinguished by a little thread wound round it, the opposite party being required to guess in which hand the marked stick is to be found. A Chinook will play at this simple game for days and nights together until he has gambled away everything he possesses even to his wife. They play, however, with much equanimity, and I never saw any ill-feeling evinced by the loser against his successful opponent. They will cheat if they can, and pride themselves on its success; if detected no unpleasant consequence follows, the offending party being merely laughed at and allowed to amend his play.

Another game to which they are very partial is played by two or three on each side; the rivals sit on the ground opposite each other with the stakes lying in the centre, one begins with his hands on the ground in which he holds four small sticks covered from sight by a small mat, these he arranges in any one of a certain number of forms prescribed by the rules of the game, and his opponent on the opposite side endeavours to guess which form he has chosen; if successful a stick is stuck up in his favour, and the sticks are handed to the next, if not the player counts and still goes on till discovered. When those on one side have gone through the others commence. At the conclusion the sticks are counted and the greater number wins. This game is also accompanied by singing, in which all the bystanders join.

Another game which I have seen amongst them is called Al-kol-loch, and is one that is universal along the Columbia river. It is considered the most interesting and important as it requires great skill. A smooth level piece of ground is chosen, and a slight barrier of a couple of sticks laid lengthways is made at each end; these are 40 or 50 feet apart and a few inches high, the two opponents, stripped naked, are armed each with a very slight spear about 3 feet long and finely pointed with bone; one of them takes a ring made of bone or some heavy wood, and wound round with cord about three inches in diameter, on the inner circumference of which are fastened six beads of different colours at equal distances, to each of which a separate numerical value is attached; the ring is then rolled along the ground to one of the barriers and is followed at the distance of

2 or 3 yards by the players, and as the ring strikes the barrier and is falling on its side the spears are thrown so that the ring may fall on them; if only one of the spears should be covered by the ring the owner of it counts according to the coloured bead over it. But it generally happens, from the dexterity of the players, that the ring covers both spears, and each count according to the colours of the beads above his weapon. They then play towards the other barrier, and so on until one party has attained the number agreed upon for game.

The Chinooks have tolerably good horses, and are fond of racing, at which they bet considerably; they are expert jockeys and ride fearlessly.

They also take great delight in a game with a ball, which is played by them in the same manner as by the Cree, Chippewa and Sioux Indians. Two poles are erected about a mile apart, and the company is divided into two bands armed with sticks, having a small ring or hoop at the end with which the ball is picked up and thrown to a great distance, each party then strives to get the ball past their own goal. There are sometimes hundreds on a side, and the play is kept up with great noise and excitement. At this game they also bet heavily, as it is generally played between tribes or villages.

The sepulchral rites of this singular tribe of Indians are too curious to be entirely omitted. Upon the death of a Chinook the body is securely tied up in rush matting and placed in the best canoe they can procure, without any peculiar ceremonies. This canoe is as highly decorated as the family of the deceased can afford. Tin cups, kettles, plates, pieces of cotton, red cloth, and furs, and in fact everything which they themselves most value, and which is most difficult for them to obtain, are hung round the canoe; inside, beside the body, they place paddles, spears, bows and arrows, and food, with everything else which they consider necessary for a very long journey,—I have even found beads, Ioquas shells, brass buttons and small coins in the mouths of the skeletons,—the canoe is then taken to the burial place of the tribe, generally selected for its isolated situation. The two principal places are rocky Islands in the lower part of the Columbia river; one is called Coffin Rock from the appearance it presents, covered with the raised biers of the deceased members of the tribe; to these they tow the canoe, which is then either fastened up in a tree or supported on a sort of frame 4 or 5 feet from the ground made of strong cedar boards, and holes bored in the bottom of the canoe to let the water run out, they are then covered with a large piece of bark to protect them from the rain. Before leaving they destroy the usefulness of every article left with the corpse, making holes in the kettles, cans, and baskets, cracking the bows, arrows and spears, and if there is a gun they take the lock off, believing that the Great Spirit will mend them upon the deceased arriving at the hunting grounds of their Elysium. The greatest crime which an Indian can commit in the eyes of his people is that of desecrating one of these canoes, and it very seldom happens that the slightest thing is removed.

In obtaining a specimen of one of the peculiarly formed skulls of the tribe I had to use the greatest precaution, and ran no small risk not only in getting it but in having it in my possession afterwards; even the voyageurs would have refused to travel with me had they known that I had it among my collections, not only on account of the superstitious dread in which they hold these burial places, but also on account of the danger arising from a discovery, which might have cost the lives of the whole party.

A few years before my arrival at Fort Vancouver, Mr. Douglass, who was then in charge, heard from his office the report of a gun inside the gates, this being a breach of discipline he hurried out to enquire the cause of so unusual a circumstance, and found one of Casenov's slaves standing over the body of an Indian whom he had just killed, and in the act of reloading his gun with apparent indifference, Casenov himself standing by. On Mr. Douglass arriving at the spot, he was told by Casenov, with an apology, that the man deserved death according to the laws of the tribe, who as well as the white man inflicted punishment proportionate to the nature of the offence. In this case the crime was one of the greatest an Indian could be guilty of, namely, the robbing the sepulchre canoes. Mr. Douglass after severely reprimanding him allowed him to depart with the dead body.

Sacred as the Indians hold their burial places, Casenov himself, a short time after the latter occurrence, had his only son buried in the cemetery of the Fort. He died of consumption—a disease very frequent amongst all Indians—proceeding no doubt from their constant exposure to the sudden vicissitudes of the climate. The coffin was made sufficiently large to contain all the necessaries supposed to be required for his comfort and convenience in the world of spirits. The chaplain of the Fort read the usual service at the grave, and after the conclusion of the ceremony, Casenov returned to his lodge, and the same evening attempted, as narrated below, the life of the bereaved mother, who was the daughter of the great chief generally known as King Comcomly, so beautifully alluded to in Washington Irving's "Astoria." She was formerly the wife of a Mr. McDougall, who bought her from her father for, as it was supposed, the enormous price of ten articles of each description, guns, blankets, knives, hatchets, &c., then in Fort Astoria. Comcomly, however, acted with unexpected liberality on the occasion by carpeting her path from the canoe to the Fort with sea otter skins, at that time numerous and valuable, but now scarce, and presenting them as a dowry, in reality far exceeding in value the articles at which she had been estimated. On Mr. McDougall's leaving the Indian country she became the wife of Casenov.

It is the prevailing opinion of the chiefs that they and their sons are too important to die in a natural way, and whenever the event takes place they attribute it to the malevolent influence of some other person, whom they fix upon, often in the most unaccountable manner, frequently selecting those the most dear to themselves and the deceased. The person so selected is sacrificed without hesitation. On this occasion Casenov selected the afflicted mother, notwithstanding she had during the sickness of her son been one of the most assiduous and devoted of his attendants, and of his several wives she was the one he most loved; but it is the general belief of the Indians on the west side of the mountains, that the greater the privation they inflict on themselves the greater would be the manifestation of their grief, and the more pleasing to the departed spirit. Casenov assigned to me an additional motive for his wish to kill his wife, namely, that as he knew she had been so useful to her son and so necessary to his happiness and comfort in this world, he wished to send her with him as his companion on his long journey. She, however, escaped into the woods, and next morning reached the Fort imploring protection; she was accordingly secreted for several days until her own relations took her home to Chinook Point. In the meantime a woman was found murdered in the woods and the act was universally attributed to Casenov or one of his emissaries.

I may here mention a painful occurrence which took place on Thompson's river, in New Caledonia, as illustrative of this peculiar superstition.

A chief dying, his widow considered a sacrifice as indispensable, but having selected a victim of rather too much importance, she was unable for some time to accomplish her object; at length the nephew of the chief, no longer able to bear the continual taunts of cowardice which she unceasingly heaped upon him, seized his gun and started for the Company's Fort on the river, about 20 miles distant. On arriving, he was courteously received by Mr. Black, the gentleman in charge of the Fort, who expressed great regret at the death of his old friend the chief. After presenting the Indian with something to eat and giving him some tobacco, Mr. Black turned to leave the room, and while opening the door was shot from behind by his treacherous guest and immediately expired. The murderer succeeded in escaping from the Fort, but the tribe, who were warmly attached to Mr. Black, took his revenge upon themselves and hunted him down. This was done more to evince their high esteem for Mr. Black than from any sense of impropriety in the customary sacrifice.

Amongst the Chinooks I have never heard any traditions as to their former origin, although such traditions are common amongst those on the east side of the Rocky Mountains. They do not believe in any future state of punishment, although in this world they suppose themselves exposed to the malicious designs of the Skŏcoom or evil genius, to whom they attribute all their misfortunes and ill luck. The Good Spirit is called the *Hias Soch-a-li Ti-yah*, that is the Great High Chief from whom they obtain all that is good in this life, and to whose happy and peaceful hunting grounds they will all eventually go, to reside for ever in comfort and abundance.

The medicine men of the tribe are supposed to possess a mysterious influence with these two spirits, either for good or evil, and of course possess great power in the tribe. These medicine men form a secret society, the initiation into which is accompanied with great ceremony and much expense. I witnessed, whilst amongst them, the initiation of a candidate, which was as follows:—The candidate has to prepare a feast for his friends and all who choose to partake of it, and make presents to the other medicine men. A lodge is prepared for him, which he enters and remains alone for three days and nights, without food, whilst those already initiated keep dancing and singing round the lodge during the whole time. After this fast, which is supposed to endue him with wonderful skill, he is taken up apparently lifeless and plunged into the nearest cold water, where they rub and wash him until he revives. This they call "washing the dead." As soon as he revives he runs into the woods, and soon returns dressed as a medicine man, which generally consists of the light down of the goose stuck all over their bodies and heads with thick grease, and a mantle of frazed cedar bark; with the medicine rattle in his hand he now collects all his property, blankets, shells and ornaments, and distributes the whole amongst his friends, trusting for his future support to the fees of his profession. The dancing and singing are still continued with great vigour during the division of the property, at the conclusion of which the whole party again sit down to feast, apparently with miraculous appetites, the quantity of food consumed being perfectly incredible.

I witnessed one day their mode of treatment of the sick whilst passing through a village. Hearing a horrible noise in one of the lodges, I entered it, and found an old woman supporting one of the handsomest girls of the tribe I had seen; cross-legged and naked in the middle of the room sat the medicine man with a wooden dish of water before him, twelve or fifteen other men sitting round the lodge. The object in view was to cure the girl of a disease affecting her side. As soon as my presence was noticed a space was cleared for me to sit down. The officiating medicine man appeared in a state of profuse perspiration from the exertions he had used, and soon took his seat amongst the rest as if quite exhausted; a younger medicine man then took his place in front of the bowl and close beside the patient; throwing off his blanket he commenced singing and gesticulating in the most violent manner, whilst the others kept time by beating with little sticks on hollow wooden bowls and drums, singing continually. After exercising himself in this manner for about half an hour, until the perspiration ran in streams down his body, he darted suddenly upon the young woman catching hold of her side with his teeth and shaking her for a few minutes, as one dog does another in fighting, the patient seeming to suffer great agony he then relinquished his hold, and cried out he had got it, at the same time holding his hands to his mouth, after which he plunged them in the water and pretended to hold down with great difficulty the disease which he had extracted lest it might spring out and return to its victim. At length having obtained the mastery over it, turning himself round to me in an exulting manner, he held something up between the finger and thumb of each hand, which had the appearance of a piece of cartilage, whereupon one of the Indians sharpened his knife and divided it in two, leaving one end in each hand. One of the pieces he threw into the water and the other into the fire, accompanying the action with a diabolical noise which none but a medicine man can make; after which he got up perfectly well satisfied with himself, although the poor patient seemed to me anything but relieved by the violent treatment she had undergone.

My principal object in travelling among the Indian tribes of the Far West was to obtain accurate sketches of their chiefs, medicine men, &c., and representations of their most characteristic manners and customs, but it was only by great persuasion that I could induce the Indians to allow me to take their portraits. They had some undefined superstitious dread of losing something by the process, as though in taking their likeness something pertaining to themselves was carried off. The women, moreover, had the idea that the possessor of their picture would hold an unlimited influence over them. In one case I had taken the likeness of a woman at the Cowlitz river, and on my return about three months afterwards, I called at the lodge of Kisséox, the chief of the tribe, where I had been in the habit of visiting frequently, and had always been received with great kindness, but on this occasion I found him and his family unusually distant in their manner, and the children even running away from me and hiding; at last he asked me if I had not taken the likeness of a woman when last amongst them, I said I had, and mentioned her name, "Cawitchum," a dead silence ensued, nor could I get the slightest answer to my enquiries. Upon leaving the lodge I met a half-breed, who told me that Cawitchum was dead, and that I was supposed to be the cause of her death. The silence was occasioned by my having mentioned a dead person's name, which is considered disrespectful to the deceased, and unlucky. I immediately left the neighbourhood, well knowing the danger that would result from my meeting with any of her relations.

Upon trying to persuade another Indian to sit for his likeness he asked me repeatedly if it would not endanger his life; being very much in want of tobacco he at length appeared convinced by my assurances that it could do him no harm, but when the picture was finished he held up the tobacco and said it was a small piece to risk his life for. I asked another Indian

while he was sitting in his lodge surrounded by his eight wives, for the same favor, but the ladies all commenced violently jabbering at me until I was glad to get off: he apparently was much gratified at the interest which his wives took in his welfare. I however met him alone some short time afterwards and got him to consent, with my usual bribe, a piece of tobacco. I could relate numerous instances of this superstitious dread of portrait painting, but the foregoing will sufficiently illustrate the general feeling on the subject.

I shall conclude this paper by relating a legend told me by an old Indian while paddling in a canoe past an isolated rock on the shore of the Pacific, as it will give an idea of the general character of the legends on the coast, which are however very few, and generally told in a very unconnected and confused manner. The rock with which the following Indian legend is associated, rises to a height of between six and seven feet above the water, and measures little more than four feet in circumference. I could not observe any very special peculiarity in the formation of this rock while paddling past it in a canoe; and, at least from the points of observation presented to my eye, no resemblance to the human figure,—such as the conclusion of the legend might lead us to anticipate,—appeared to be traceable. Standing, however, as this rock does, entirely isolated, and without any other being visible for miles around, it has naturally become an object of special note to the Indians, and is not uncalculated, from its solitary position to be made the scene of some of the fanciful creations of their superstitious credulity. 'It is many moons since a Nasquawley family lived near this spot. It consisted of a widow with four sons; one of them was by her first husband the other three by her second, the three younger sons treated their elder brother with great unkindness, refusing him any share of the produce of their hunting and fishing; he, on the contrary, wishing to conciliate them, always gave them a share of his spoils. He in fact was a great medicine man, although this was unknown to them, and being tired of their harsh treatment, which no kindness on his part seemed to soften, he at length resolved to retaliate. He accordingly one day entered the lodge where they were feasting and told them that there was a large seal a short distance off. They instantly seized their spears and started in the direction he pointed out, and coming up to the animal the eldest drove his spear into it. This seal was "a great medicine," a familiar of the elder brother who had himself created him for the occasion; the foremost of them had no sooner driven in his spear than he found it impossible to disengage his hand from the handle or to draw it out; the two others drove in their spears and with the like effect. The seal now took to the water, dragging them after it, and swam far out to sea; having travelled on for many miles they saw an island in the distance, towards which the seal made, on nearing the shore they found that they could, for the first time, remove their hands from their spears; they accordingly landed, and supposing themselves in some enemies country, they hid themselves in a clump of bushes from observation; while lying concealed they saw a diminutive canoe coming round a point in the distance, paddled by a very little man, who, when he came opposite to where they were, anchored his boat with a stone attached to a long line, without perceiving them. He now sprang over the side, and diving down, remained a long time under water, at length he rose to the surface and brought with him a large fish, which he threw into the boat; this he repeated several times, each time looking in to count the fish he had caught. The three brothers being very hungry, one of them offered to swim out while the little man was under water and steal one of the fish; this he safely accomplished before the return of the fisherman, but the little fellow no sooner returned with another fish than he discovered that one of those already caught was missing, and stretching out his hand he passed it slowly along the horizon, until it pointed directly to their place of concealment. He now drew up his anchor and paddled to the shore, and immediately discovered the three brothers; and being as miraculously strong as he was diminutive, he tied their hands and feet together and throwing them into his canoe, jumped in and paddled back in the direction from whence he had come. Having rounded the distant point where they had first descried him, they came to a village inhabited by a race of people as small as their captor, their houses, boats and utensils being all in proportion to themselves. The three brothers were taken out and thrown bound as they were into a lodge, while a council was convened to decide upon their fate. During the sitting of the council an immense flock of birds resembling geese, but much larger, pounced down upon the inhabitants and commenced a violent attack. These birds had the power of throwing their sharp quills like the porcupine, and though the little warriors fought with great valour they soon became covered with the piercing darts, and all sunk insensible on the ground; when all resistance had ceased the birds took to flight and disappeared. The three brothers had witnessed the conflict from their place of confinement, and with much labour had succeeded in releasing themselves from their bonds, when they went to the battle ground and commenced pulling the quills from the apparently lifeless bodies, but no sooner had they done this than all instantly returned to consciousness. When all of them had become well again they wished to express their gratitude to their preservers and they offered to grant whatsoever they should desire; the three brothers therefore requested to be sent back to their own country. A council was accordingly called to decide on the easiest mode of doing so, and they eventually determined upon employing a whale for the purpose. The three brothers were then seated on the back of the monster and proceeded in the direction of Nasquawley; however, when they had reached about half way the whale began to think what a fool he was for carrying them instead of turning them into porpoises and letting them swim home themselves. Now the whale is considered as a "Soch-a-li" or Great Spirit,—although not the same as the "Hias Ti-yah," possessing greater powers than all other animals put together, and no sooner had he thought upon the matter than he carried it into effect. This accordingly is the way that the porpoises first came into existence, and accounts for their being constantly at war with the seals, one of which species was the cause of their first misfortunes. After the three brothers had so strangely disappeared their mother came down to the beach and remained there for days watching for their return and bewailing their absence with tears. Whilst thus engaged one day the whale happened to pass by, and taking pity on her distress he turned her into that stone.'

Food and its Adulterations.*

The world at large has almost forgotten Accum's celebrated work 'Death in the Pot;' a new generation has indeed sprung up since it was written, and fraudulent tradesmen and manufacturers have gone on in silence, and, up to this time, in security, falsifying the food and picking the pockets of the people. Startling indeed as were the revelations in that

* Abridged from the *London Quarterly*, April, 1855.

remarkable book, yet it had little effect in reforming the abuses it exposed. General denunciations of grocers did not touch individuals of the craft, and they were consequently not driven to improve the quality of their wares. The *Lancet* Commission went to work in a different manner. In Turkey, when of old they caught a baker giving false weight or adulterating the staff of life, they nailed his ear to the doorpost, 'pour encourager les autres.' Dr. Hassall, like a modern Al Rachid, perambulated the town himself, or sent his trustworthy agents to purchase articles, upon all of which the inexorable microscope was set to work, and every fraudulent sample, after due notice given, subjected its vendor to be pinned for ever to the terrible pages of the Commissioners' report. In this manner direct responsibility was obtained. If the falsification denounced was not the work of the retailer, he was glad enough to shift the blame upon the manufacturer, and thus the truth came out.

A gun suddenly fired into a rookery could not cause a greater commotion than this publication of the names of dishonest tradesmen, nor does the daylight, when you lift a stone, startle ugly and loathsome things more quickly than the pencil of light, streaming through a quarter-inch lens, surprised in their naked ugliness the thousand and one illegal substances which enter more or less into every description of food that it will pay to adulterate. Nay, to such a pitch of refinement has the art of falsification of alimentary substances reached, that the very articles used to adulterate are adulterated; and while one tradesman is picking the pockets of his customers, a still more cunning rogue is, unknown to himself, deep in his own!

The manner in which food is adulterated is not only one of degree but of kind. The most simple of all sophistications, and that which is most harmless, is the mixture of inferior qualities of the same substance. Indeed, if the price charged were according to quality, it would be no fraud at all, but this adjustment rarely takes place. Secondly, the mixture of cheaper articles of another kind; Thirdly, the surreptitious introduction of materials which, taken in large quantities, are prejudicial to health; and Fourthly, the admixture of the most deadly poisons in order to improve the appearance of the article 'doctored.'

The microscope alone is capable of detecting at one operation the nature and extent of the more harmless but general of these frauds. When once the investigator, by aid of that instrument, has become familiar with the configurations of different kinds of the same chemically composed substances, he is armed with far greater detective power than chemical agents could provide him with. It is beyond the limit of the test-tube to show the mind the various forms of animal and vegetable life which exist in impure water; delicate as are its powers it could not indicate the presence of the sugar insect, or distinguish with unerring nicety an admixture of the common Circuma arrowroot with the finer Maranta. Chemistry is quite capable of telling the component parts of any article: what are the definite forms and natures of the various ingredients which enter into a mixture it cannot so easily answer. This the microscope can at once effect, and in its present application consists Dr. Hassall's advantage over all previous investigators in the same field. The precision with which he is enabled to state the result of his labors leaves no appeal; he shows his reader the intimate structures of a coffee-grain and of oak or mahogany sawdust; and then a specimen of the two combined, sold under the title of genuine Mocha. Many manufacturers and retailers, who have been detected falsifying the food of the public, have threatened actions, but they all flinched from the test of the unerring instrument.

THE CRUET-STAND.

The system of adulteration is so wide-spread and embraces so many of the items of the daily meal, that we scarcely know where to begin—what corner of the veil first to lift. Let us hold up the cruet-frame, for example, and analyse its contents. There is mustard, pepper (black and cayenne), vinegar, anchovy and Harvey sauce—so thinks the unsuspecting reader—let us show him what else beside. To begin with mustard. 'Best Durham,' or 'Superfine Durham,' no doubt it was purchased for, but we will summarily dismiss this substance by stating that it is impossible to procure it pure at all; out of forty-two samples bought by Dr. Hassall at the best as well as inferior shops, all were more or less adulterated with wheaten flour for bulk, and with turmeric for colour. Vinegar also suffers a double adulteration; it is first watered, and then pungency is given to it by the addition of sulphuric acid. A small quantity of this acid is allowed by law; and this is frequently trebled by the victualers. The pepper-caster is another stronghold of fraud—fraud so long and openly practised, that we question if the great mass of the perpetrators even think they are doing wrong. Among the milder forms of sophistication to which this article is subjected are to be found such ingredients as wheaten flour, ground rice, ground mustard-seeds, and linseed-meal. The grocer maintains a certain reserve as to the generality of the articles he employs in vitiating his wares, but pepper he seems to think is given up to him by the public to 'cook' in any manner he thinks fit. This he almost invariably does by the addition of what is known in the trade as P.D., or pepper-dust, alias the sweeping from the pepper-warehouse. But there is a lower depth still; P. D. is too genuine a commodity for some markets, and it is accordingly mixed with D. P. D., or dirt of pepper-dust.

Out of twenty-eight samples of cayenne pepper submitted to examination, no less than twenty-four were adulterated with white mustard-seed, brickdust, salt, ground rice, and *deal sawdust*, by way of giving bulk; but as all of these tend to lighten the colour, it is necessary to heighten it to the required pitch. And what is employed to do this? Hear and tremble, old Indians, and lovers of high-seasoned food—with RED LEAD. Out of twenty-eight samples, red lead, and *often in poisonous quantities*, was present in thirteen! Who knows how many 'yellow admirals' at Bath have fallen victims to their cayenne-cruets? Nor can it be said that the small quantity taken at a time could do no permanent mischief, for lead belongs to the class of poisons which are cumulative in their effects.

He who loves cayenne, as a rule is fond of curry-powder, and here also the poisonous oxide is to be found in large quantities. Some years ago a certain amiable duke recommended the laboring population, during a season of famine, to take a pinch of this condiment every morning before going to work, as "warm and comforting to the stomach.' If they had followed his advice, thirteen out of every twenty-eight persons would have imbibed a slow poison. Those who are in the habit of using curry, generally take it in considerable quantities, and thus the villanous falsification plays a more deadly part than even in cayenne pepper. Imagine a man for years pertinaciously painting his stomach with red lead! We do not know whether medical statistics prove that paralysis prevails much among 'Nabobs,' but of this we may be sure that there could be no more fruitful source of it than the two favorite stimulants we have named.

MEAT AND BREAD.

Some years ago 'the Goldner canister business' so excited the public against this invaluable method of storing perishing

articles of food, that a prejudice has existed against it ever since—and a more senseless prejudice could not be. Goldner's process, since adopted by Messrs. Cooper & Aves, is simple and beautiful. The provisions, being placed in tin canisters having their covers soldered down, are plunged up to their necks in a bath of chloride of calcium (a preparation which imbibes great heat without boiling), and their contents are speedily cooked; at the same time, all the air in the meat, and some of the water, are expelled in the form of steam, which issues from a pin-hole in the lid. The instant the cook ascertains the process to be complete, he drops a plug of solder upon the whole, and the mass is thus hermetically sealed. Exclusion of air, and coagulation of the albumen, are the two conditions, which enable us to hand the most delicate flavoured meats down to remote generations,—for as long, in fact, as a stout painted tin canister can maintain itself intact against the oxidating effect of the atmosphere. We have ourselves partaken lately of a duck that was winged, and of milk that came from the cow as long as eight years ago. Fruit which had been gathered whilst the free trade struggle was still going on, we found as delicate in flavour as though it had just been plucked from the branch. Out of the many cases of all kinds of provisions opened and examined by Dr. Hassall, scarcely any have been found to be bad. In the preserved meats, which are made up with potatoes and other vegetables, the needful potass exists, and such food may be forwarded to the Crimea as cheaply as the pernicious salt junk which is patronised by the Government.

When we see a loaf marked under the market-price, we may rest assured that it is made from flour ground from inferior and damaged wheat. In order to bring this up to the required colour, and destroy the sour taste which often belongs to it, bakers are in the habit of introducing a mixture called in the trade 'hards' and 'stuff,' which is nothing more than alum and salt kept prepared in large quantities by the druggists. The quantity of alum necessary to render bread white is certainly not great—Mitchell found that it ranged from 116 grains to 34½ grains in the four-pound loaf—but the great advantage the baker derives from it, in addition to improving the colour of his wares, is, that it absorbes a large quantity of water, which he sells at the present time at the rate of 2*d.* per pound. Out of twenty-eight loaves of bread bought in every quarter of the metropolis, Dr. Hassall did not find one free from the adulteration of alum, and in some of the samples he found considerable quantities. As a general rule, the lower the neighbourhood, the cheaper the bread, and the greater the quantity of these 'hards' or 'stuff' introduced.

TEA AND COFFEE.

Our succeeding remarks will fall, we fear, like a bomb upon many a tea-table, and stagger teetotalism in its stronghold. A drunkard's stomach is sometimes exhibited at total-abstinence lectures, in every stage of congestion and inflammation, painted up to match the fervid eloquence of the lecturer. If tea is our only refuge from the frightful maladies entailed upon us by fermented liquors, we fear the British public is in a perplexing dilemma. Ladies, there is death in the teapot! Green-tea drinkers, beware! There has always been a vague idea afloat in the public mind about hot copper plates—a suspicion that gunpowder and hyson do not come by their colour honestly. The old Duchess of Marlborough used to boast that she came into the world before 'nerves was in fashion.' We feel half inclined to believe this joke had a great truth in it; for since the introduction of tea, nervous complaints of all kinds have greatly increased; and we need not look far to find one at least of the causes in the teapot. There is no such a thing as pure green tea to be met with in England. It is adulterated in China; and we have lately learnt to adulterate it at home almost as well as the cunning Asiatic. The pure green tea made from the most delicate green leaves grown upon manured soil, such as the Chinese use themselves, is, it is true, wholly untainted; and we are informed that its beautiful bluish bloom like that upon a grape, is given by the third process of roasting which it undergoes. The enormous demand for a moderately-priced green tea which has arisen both in England and China since the opening of the trade, has led the Hong merchants to imitate this peculiar colour; and this they do so successfully as to deceive the ordinary judges of the article. Black tea is openly coloured in the neighbourhood of Canton, in the most wholesale manner.

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Mr. Robert Fortune, in his very interesting work, 'The Tea Districts of China and India,' gives us a good description of the manner in which this colouring process is performed, as witnessed by himself.

'Having procured a portion of Prussian-blue, he threw it into a porcelain bowel, not unlike a chemist's mortar, and crushed it into a very fine powder. At the same time a quantity of gypsum was produced and burned in the charcoal fires which were then roasting the teas. The object of this was to soften it, in order that it might be readily pounded into a very fine powder, in the same manner as the Prussian-blue had been. The gypsum, having been taken out of the fire after a certain time had elapsed, readily crumbled down, and was reduced to powder in the mortar. These two substances, having been thus prepared, were then mixed together in the proportion of four parts of gypsum to three parts of Prussian-blue, and formed a light blue powder, which was then ready for use.

'This colouring matter was applied to the teas during the process of roasting. About five minutes before the tea was removed from the pans—the time being regulated by the burning of a joss-stick—the superintendent took a small porcelain spoon, and with it he scattered a portion of the coloring matter over the leaves in each pan. The workmen then turned the leaves round rapidly with both hands, in order that the colour might be equally diffused. During this part of the operation the hands of the workmen were quite blue. I could not help thinking if any green-tea drinkers had been present during the operation their taste would have been corrected and I believe improved.

'One day an English gentleman in Shanghae, being in conversation with some Chinese from the green-tea country, asked them what reason they had for dying the tea, and whether it would not be better without undergoing this process. They acknowledged that tea was much better when prepared without having any such ingredients mixed with it, and that *they never drank dyed teas* themselves, but justly remarked, that, as foreigners seemed *to prefer having a mixture of Prussian-blue and gypsum with their tea* to make it look uniform and pretty, and as these ingredients were cheap enough, the Chinese had no objection to supply them, especially as such teas always fetched a higher price.

'I took some trouble to ascertain precisely the quantity of colouring matter used in the process of dyeing green teas, not certainly with the view of assisting others, either at home or abroad, in the art of colouring, but simply to show green-tea drinkers in England, and more particularly in the United States of America, what *quantity* of Prussian-blue and gypsum they

imbibe in the course of one year. To 14½ lbs. were applied 8 mace 2½ caudereens of colouring matter, or rather more than an ounce. To every hundred pounds of coloured green tea consumed in England or America, the consumer actually drinks more than half a pound of Prussian-blue and gypsum. And yet, tell the drinkers of this coloured tea that the Chinese eat cats and dogs, and they will hold up their hands in amazement aud pity the poor Celestials.'

If the Chinese use it in these quantities to tinge the genuine leaf, how much more must the Euglish employ in making up afresh exhausted leaves! That every spoonful of hyson or gunpowder contains a considerable quantity of this deleterious dye will be seen by any one who places a pinch upon a fine sieve, and pours upon it a gentle stream of water, when the tinging of the liquid will show at once the extent of the adulteration, and the folly of drinking painted tea. Assam tea, though not so inviting in colour, is free from adulteration. A word to the wise is enough.

Of fifty samples of green tea analysed by Dr. Hassall, all were adulterated. There is one particular kind which is almost entirely a manufactured article—gunpowder, both black and green—the former being called scented caper. Both have a large admixture of what is termed 'lye tea,' or a compound of sand, dirt, tea-dust, and broken-down portions of other leaves worked together with gum into small nodules. This detestable compound, which, according to Mr. Warrington,* who has analysed it, contains forty-five per cent. of earthly matter, is manufactured both in China and in England, for the express purpose of adulterating tea. When mixed with 'scented caper' it is 'faced' with black lead; when with gunpowder, Prussiau-blue; turmeric and French chalk give it the required bloom. Mr. Warrington states that about 750,000 lbs. of this spurious tea have been imported into Great Britain within eighteen months! Singularly enough the low-priced teas are the only genuine ones. Every sample of this class which was analysed by Dr. Hassall proved to be perfectly pure. Here at least the poor have the advantage of the better classes, who pay a higher price to be injured in their health by a painted beverage.

The practice of redrying used-up leaves is also carried on to some extend in England. Mr. George Philips of the Inland Revenue Office, states that in 1843 there were no less than eight manufactories for the purpose of redrying tea-leaves in London alone, whilst there were many others in different parts of the country. These manufacturers had agents who bought up the used leaves from hotels, clubs, coffeehouses, &c., for twopence-half-penny and threepence per lb. With these leaves, others of various trees were used, and very fine pekoe still flourishes upon the hawthorn-bushes, sloe-trees, &c., around the metropolis. As late as the year 1851 the following account of the proceedings of one of these nefarious manufacturers appeared in *The Times:*—

If the better class of black and green teas† are thus vilely adulterated, the reader may fancy that he can at least take refuge in coffee—alas! in too many cases he will only avoid Scylla to fall into Charybdis. Coffee, as generally sold in the metropolis and in all large towns, is adulterated more than tea. The Treasury Minute, which allowed it to be mixed with chicory, is at the head aud front of the offending. In the year 1840 this celebrated Minute was issued by the sanction of the then Chancellor of Exchequer, Sir C. Wood, the immediate consequence of which was that grocers began to mix it with pure coffee in very large quautities, quite forgetting to inform the public of the nature of the mixture, and neglecting at the same time to lower the price. The evil became so flagrant that upon the installatiou of the Derby administration, Mr. Disraeli promised to rescind this license to adulterate; but before the promise was redeemed, the administration was rescinded itself. Mr. Gladstone, upon his acceptance of office, loath, it appears, to injure the chicory interest, modified the original Minute, but allowed the amalgamation to continue, provided the package was labelled 'Mixture of Chicory and Coffee.' It was speedily found, however, that this announcement became so confounded with other printing ou the label that it was uot easily distinguishable, and in consequence it was provided that the words, 'This is sold as a mixture of Chicory and Coffee,' should be printed by themselves on one side of the cauister. It may be asked what is the nature of this ingredient, that the right to mix it with coffee should be maintained by two Chancellors of the Exchequer during a period of fifteen years as jealously as though it were some important principle of our constitution? Chicory, to say the best of it, is an insipid root, totally destitute of any nourishing or refreshing quality, being utterly deficient in any nitrogenized principle, whilst there are strong doubts whether it is not absolutely hurtful to the nervous system. Professor Beer, the celebrated oculist of Vienna, forbids the use of it to his patients, considering it to be the cause of amaurotic blindness. Even supposing it to be perfectly harmless, we have a material of the value of 8*d.* a pound, which the grocer is allowed to mix *ad libitum* with one worth 1*s.* 4*d.* If the poor got the benefit of the adulteration, there might be some excuse for permitting the admixture of chicory, but it is proved the combination is sold in many shops at the same price as pure coffee. Analyses made by Dr. Hassall of upwards of a hundred different samples of coffee, purchased in all parts of the metropolis before the issuing of the order for the labelling of the packages 'chicory and coffee,' proved that, in a great number of cases, articles sold as 'finest Mocha,' 'choice Jamaica coffee,' 'superb coffee,' &c., contained, in some cases, very little coffee at all; in others 'only a fifth, a third, half,' &c., the rest being made up mainly of chicory.

THE SUGAR-BASIN.

We are afraid, if we look into the sugar-basin, we shall not find much more comfort than in the milk-jug. We refer here to the ordinary brown sugars, such as are generally used at the breakfast-table for coffee. It is scarcely possible to procure moist sugar which is not infested with animalcula of the acari genus, a most disgusting class of creatures. In many samples of sugars they swarm to that extent that the mass moves with them; and in almost every case, by dissolving a spoonful in a wine-glass of water, dozens of them can be detected by the naked eye, either floating upon the liquid or adhering to the edge of the glass. Those who are in the habit of 'handling' sugars, as it is termed, are liable to a skin affection called the grocer's itch, which is believed to be occasioned by these living inhabitants of our sugar-basins. Horrible as it is to think that such creatures are au article in daily use, we cannot charge the grocer directly with their iutroduction; the evil is, however, increased by the manner in which he mixes, or 'handles,' as it is termed iu the trade, higher-priced sugars with muscovados, bastards, aud other inferior kinds, in which the animal-

* In an article upon the teas of commerce, which appeared in the 'Quarterly Journal of the Chemical Society' for July, 1851.

† Assam tea is the only exception to this rule.

cula abound. In addition to this foreign animal element, grocers sometimes mix flour with their sugar, and, if we are to put any credit in popular belief, sand; but of the presence of this gritty ingredient we have never seen any trustworthy evidence. Nevertheless we have said enough to show that the tea-dealer and grocer do their best to supply the proverbial 'peck of dirt' which all of us must eat before we die. Would that we were fed with nothing more deleterious or repulsive! Let us see, however, the base admixtures one is liable to swallow in taking—

A Cup of Tea *or a*	Cup of Coffee.
In the Tea.	*In the Coffee.*
If Green.	Chicory.
Prussian-blue.	*In the Chicory.*
Turmeric.	Roast wheat.
China clay or French chalk.	" acorn.
Used tea-leaves.	" mangold-wurzel.
Copperas.	" beans.
If Black.	" carrots.
Gum.	" parsnips.
Black lead.	" lupin-seeds,
Dutch pink.	" dog-biscuit.
Used tea-leaves.	" horse-chesnuts.
Leaves of the ash, sloe hawthorn, and of many other kinds.	Oxide of iron.
	Mahogany sawdust.
In the Milk.	Baked horse's liver.
	" bullock's liver.
On an average 25 per cent. of water.	*In the Milk.*
Annatto.	Water 25 per cent.
Treacle.	Annatto.
Flour.	Flour.
Oxide of iron.	Treacle.
And other unknown ingredients.	Oxide of iron.
	And other unknown ingredients.
In the Sugar.	*In the Sugar.*
If brown—	If Brown—
Wheat flour.	Wheat flour.
Hundreds of the sugar insects.	Hundreds of the sugar insect.
If White—	If White—
Albumen of bullock's blood.	Albumen of bullock's blood.

We shall not dwell upon cocoa further than to state that it is a still rarer thing to obtain it pure, than either tea or coffee. The almost universal adulterations are sugar, starch, and flour, together with red colouring matter, generally some ferruginous earth; whilst, as far as we can see, what is termed homœopathic cocoa is only distinguished from other kinds by the small quantity of that substance contained in it.

PICKLES.

Accum, in his 'Death in the Pot,' quotes, from cookery-books of reputation in his day, recipes which make uninitiated persons stare. For instance, 'Modern Cookery, or the English Housewife,' gives the following serious directions 'to make Greening:'—'Take a bit of *verdigris the bigness of a hazel-nut*, finely powdered, half a pint of distilled vinegar, and a bit of alum-powder, with a little baysalt; put all in a bottle and shake it, and let it stand till clear. *Put a small teaspoonful into codlings, or whatever you wish to green.*

Again, the 'English Housekeeper,' a book which ran through 18 editions, directs—'to make pickles green *boil them with half-pence*, or allow them to stand for twenty-four hours in copper or brass pans!' Has the notable housewife ever wondered to herself, how it is that all the pickles of the shops are of so much more inviting colour than her own?—we will satisfy her curiosity at a word—she has forgotten the 'bit of verdigris the bigness of a hazel-nut,' for it is now proved beyond doubt, that to this complexion do they come by the use of copper, introduced for the sole purpose of making them of a lively green. The analyses of twenty samples of pickles bought of the most respectable tradesmen proved, firstly, that the vinegar in the bottles owed most of its strength to the introduction of sulphuric acid; secondly, that out of sixteen different pickles analysed for the purpose, copper was detected in various amounts. Thus 'two of the samples contained a small quantity; eight rather much, one a considerable quantity, three a very considerable quantity; in one copper was present in a highly deleterious amount, and in two *in poisonous amounts.* The largest quantity of this metal was found in the bottles consisting entirely of green vegetables, such as gherkins and beans.'

We trust after this the good housewife will feel jealous no longer, but rest satisfied that the home-made article, if less inviting and vivid in colour, is at least more wholesome. A simple test to discover the presence of copper in such articles is to place a bright knitting-needle in the vinegar, and let it remain there for a few hours, when the deleterious metal will speedily form a coating over it, dense or thin, according to the amount which exists. Wherever large quantities are found, it is wilfully inserted for the purpose of producing the bright green colour, but a small quantity may find its way into the pickles in the process of boiling in the copper pans. Messrs. Crosse and Blackwell, the great pickle and preserve manufacturers in Soho, immediately they became aware, from the analyses of the *Lancet*, that such was the case, in a very praiseworthy manner substituted silver and glass at a great expense, for all their former vessels. The danger arising from the introduction of this virulent poison into our food would not be so great if it were confined to pickles, of which the quantity taken is small at each meal, but it is used to paint all kinds of preserves, and fruits for winter pies and tarts are bloomed with death. The papa who presents his children with the box of sweetmeats bedded in coloured paper, and enclosed in an elegant casket, may be corroding unawares the very springs of their existence. As a general rule it is found that the red fruits, such as currents, raspberries, and cherries, are uncontaminated with this deleterious metal, but owe their deep hue to some red colouring matter, such as a decoction of logwood, or infusion of beetroot, in the same way that common white cabbage is converted into red, by the nefarious pickle-merchant. The green fruits are not all deleterious in the same degree; there seems to be an ascending scale of virulence, much after the following manner;—Limes, gooseberries, rhubarb, greengages, olives—the last-mentioned fruit, especially those of French preparation, generally containing verdigris, or the acetate of copper, *in highly dangerous quantities.* The *Lancet* publishes a letter from Mr. Bernays, F.C.S., dated from the Chemical Library, Derby, in which he shows the necessity of watchfulness in the purchase of these articles of food:—

'Of this,' he says, 'I will give you a late instance. I had bought a bottle of preserved gooseberries from one of the most respectable grocers in the town, and had its contents transferred to a pie. It struck me that the gooseberries looked fearfully green when cooked; and in eating one with a steel fork, its intense bitterness sent me in search for the sugar. After having sweetened and smashed the gooseberries, with the same steel fork, I was about to convey some to my mouth, when I observed the prong to be completely coated with a thin film of bright metallic copper. My testimony can be borne out by the evidence of others, two of whom dined at my table.'

It was fortunate that these three gentlemen used steel forks, which instantly disclosed the mischief: if they had chanced to use silver, all three might have fallen victims to these poisonous conserves.

But we are not yet at the worst. When Catherine de Medicis wished to get rid of obnoxious persons in an 'artistic' manner, she was in the habit of presenting them with delicately made sweetmeats, or trinkets, in which death lurked in the most engaging manner; she carried

'Pure death in an earring, a casket,
A signet, a fan-mount, a filigree basket.'

Her poisoned feasts are matters of history, at which people shudder as they read; but we question if the diabolical revenge and cold-blooded wickedness of an Italian woman ever invented much more deadly trifles than our low, cheap confectioners do on the largest scale.

OF SUGAR ORNAMENT.

The painted feast contains, among its highly injurious ingredients, ferrocyanide of iron or Prussian-blue, Antwerp-blue-gamboge, and ultramarine, and among its deadly poisons the three chrome yellows, red lead, white lead, vermilion, the three Brunswick greens, and Scheele's green or arsenite of copper. The wonder is that, considering we set such poison-traps for children, ten times more enticing and quite as deadly as those used to bane rats, that the greater number of youngsters who partake of them are not at once despatched, and so undoubtedly they would be if nurses were not cautious about these coloured parts, which have always enjoyed a bad name under the general denomination of 'trash and messes.' As it is, we are informed by Dr. Letheby that 'no less than seventy cases of poisoning have been traced to this source' within three years!

In France, Belgium, and Switzerland the colouring of confectionery with poisonous pigments is prohibited, and the vendors are held responsible for all accidents which may occur to persons from eating their sugar confectionery.

All kinds of sugar-plums, comfits, and 'kisses,' in addition to being often adulterated with large quantities of plaster of Paris, are always open to the suspicion of being poisoned. Necessity cannot be urged for the continuance of this wicked practice, as there are plenty of vegetable pigments which, if not quite so vivid as the acrid mineral ones, are sufficiently so to please the eye. Of late years a peculiar lozenge has been introduced, in which the flavour of certain fruits is singularly imitated. Thus we have essence of jargonel drops, essence of pine-apple drops, and many others of a most delicate taste. They really are so delicious that we scarcely like to create a prejudice against them; but the truth is great and must prevail: all these delicate essences are made from a preparation of æther and rancid cheese and butter.

If we could possibly eliminate, from the mass of human disease, that occasioned by the constant use of deleterious food, we should find that it amounted to a very considerable percentage on the whole, and that one of the best friends of the doctor would prove to be the adulterator. But even our refuge fails us in our hour of need; the tools of the medical man, like those of the sappers and miners before Sebastopol, often turn out to be worthless. Drugs and medical comforts are perhaps adulterated as extensively as any other article. To mention only a few familiar and household medicines for instance:—Epsom salts are adulterated with sulphate of soda; carbonate of soda with sulphate of soda—a very injurious substitute. Mercury is sometimes falsified with lead, tin, and bismuth; gentian with the poisonous drugs aconite and belladonna; rhubarb with turmeric and gamboge; cantharides with black pepper; and cod-liver and castor oils with common and inferior oils; whilst opium, one of the sheet-anchors of the physician, is adulterated to the greatest extent in a dozen different ways. Medical comforts are equally uncertain. Thus potato-flour forms full half of the so-called arrow-roots of commerce; sago-meal is another very common ingredient in this nourishing substance. Out of fifty samples of so styled arrow-root, Dr. Hassall found twenty-two adulterated, many of them consisting *entirely* of potato-flour and sago-meal. One-half of the common oatmeals to be met with are adulterated with barley meal, a much less nutritious substance—an important fact, which boards of guardians should be acquainted with. Honey is sophisticated with flour-starch and sugar-starch. And lastly, we wish to say something important to mothers. Put no faith in the hundred and one preparations of farinaceous food for infants which are paraded under so many attractive titles. They are all composed of wheat-flour, potato-flour, sago, &c.,—very familiar ingredients, which would not take with anxious parents unless christened with extraordinary names, for which their compounders demand an extraordinary charge. To invalids we would also say, place no reliance on the Revalentas and Ervalentas advertised through the country as cures for all imaginary diseases. They consist almost entirely of lentil-powder, barley-flour, &c., which are charged cent. per cent. above their real value.

Of all the articles we have touched upon, not one is so important as water. It mixes more or less with all our solid food, and forms nine-tenths of all our drinks. Man himself, as a sanitary writer has observed, is in great part made up of this element, and if you were to put him under a press you would squeeze out of him $8\frac{1}{2}$ pailfuls. That it should be furnished pure to the consumer is of the first importance in a sanitary and economic point of view.

The Unity of the Human Race.*

Experience has taught us not too hastily to charge any scientific theory with being contradictory to Scripture. Freedom of speculation is rightly privileged. Revealed truth is not endangered by discussion and investigation.

Hence, when a theory is proposed to us like that of the specific difference between the several races of mankind, we shall do well to receive it without anger or contempt, and to enquire whether it may not be possibly consistent with Theological and physiological science.

That the whole human race has sprung from one male and one female at the first, seems, however, to be distinctly taught in Holy Scripture, and to be a matter of the highest antecedent probability from physical considerations.

The doctrine of our oneness of origin, let it be noted, does not depend upon a single text, such as that which affirms that "God hath made of one blood all the nations of men." Though this passage, and others like it, should be explained away, that doctrine could not perish with them. For all Scripture either asserts or else assumes the unity of the human family. Adam by transgression fell; mankind in general were involved in the fall. They have an hereditary taint; their nature is corrupted, because they are his offspring. And their redemption comes

* *Canadian Journal*, May, 1855.

by means analagous to that which brought their ruin on them. The Redeemer takes their nature, and makes them partakers of his own divine nature. "As in Adam all die, even so in Christ shall all be made alive." Hence, this strange assertion of a plurality of species among mankind seems altogether inconsistent with the revealed word. To accept it is, in all appearance at least, to lose our faith in the intelligibility, the practical utility of Scripture. The language of inspiration is surely wanting in any definite significance at all, if it can by any means be made susceptible of an interpretation in favor of the view in question. We know, indeed, the arguments which are adduced from Astronomy and from Geology, in their relation to the language of the Bible, as being applicable likewise to the matter now under consideration. But is there really any parallelism in the case? *The motion of the sun* is spoken of in the Old Testament,—a fact once urged against the truth of the Copernican system. Yet the inspired writers, when they used such language, were not teaching us astronomy; and, for the purpose merely of describing things as they appear, the expression is so natural, that knowing as we do the actual fact, we still are wont to say that *the sun has risen—has travelled upwards to the meridian—is going down towards the west.*

So, too, with respect to the theories of the Geologist. His science, also, has been thought incompatible with the Mosaic history of the creation of our world. For Scripture saith, "In six days the Lord made heaven and earth." Modern Geology declares that a creative work has been proceeding on the earth, throughout *myriads*, nay *hundreds of thousands of years!*

But then we learn to think the less of this apparent difficulty, on discovering that the word *day* has no uniform nor fixed signification in the Holy Scriptures. We are therein told, for instance, that "one day is with the Lord as a thousand years, and a thousand years as one day." Again, it is admitted, with the common consent of the interpreters of Scriptural predictions, that in the prophetical vocabulary *day* stands for *year*.

There is, therefore, as we may say, nothing in the above examples from Astronomy and Geology amounting to a contradiction of the words of Scripture, when they are fairly construed and explained. And there is, at the same time, an immense amount of evidence in their favor, as scientific truths.

That the sun is, so far at least as this earth is concerned, the fixed centre around which we circulate, has been conclusively demonstrated; so that *we must* interpret Scripture language consistently with this established fact. The results of geological research are not yet, indeed, so familiar to the unlearned many, neither are the principles of geology as yet so capable of demonstration as are the principles of Astronomy. Still, the Geologist finds certain fundamental principles in his favorite science, of the necessary truth of which he is assured upon the evidence of his own reason, and of his physical senses, and of arithmetical computation. And of such sort is his proposition concerning the vast antiquity of those organic and animal remains which he discovers in the earlier strata of the crust of the earth; insomuch that whoever takes the trouble to investigate the subject, is, in a manner, driven to adopt his conclusion.

But how stands the case, with respect to the question of one or many species in the genus BIMANA?

There is no true connection, as we have seen, between these several theories in the matter of their respective harmony or variance with Holy Scripture. Let it, now, be further affirmed, that neither is there any closer resemblance between them, when their scientific merits are compared. Zoology is certainly unfavorable, upon the whole, to this theory of a specific difference of race among mankind. Such arguments as we can derive from analogy tell strongly against it.

It is an established general fact, that the offspring of a male and female of diverse kind is barren. Particular exceptions to this rule may be on record, but the rule itself stands good. The mule we get by pairing the horse with the ass, cannot propagate its kind; neither are those hybrids of the Fringilla genus, which bird-fanciers delight in breeding, found to be prolific. But it is otherwise with human beings. The union of their various races has always been productive of a progeny perfect in every physical function, fully capable of continuing the race. Experience teaches us, in fact, that we have to fear, not the mixture of any foreign stock, but rather the continuance of intermarriages among tribes too nearly connected—*the breeding in and in.*

The strongest argument, however, of the advocates for a specific difference among men, may be, perhaps, that which they find in the great bodily variations which evidently exist. There are races of men, they argue, so opposite, not alone in color or in stature, but in more fixed and fundamental characteristics, as in the configuration of the skull, that they must necessarily be of different origin. Now this diversity is certainly strange and mysterious; and yet we see variety as marked among domestic animals, whose identity of species is unquestioned by Zoologists. In that one species of the equine genus which we call, *par excellence*, the horse, the differences of size and shape are very great. Our more familiar friend, the dog, furnishes us with examples even more remarkable of deviations from his own common type.

Among direct arguments in favor of the common origin of all men, the philologist produces one, drawn from his perception of a single source and root of all existing languages. And his reasoning seems weighty; but it must be sufficient here to make this passing allusion to the aid he has to offer us.

And, to make an end of words already too much multiplied, strange is it to find some men so restless, so dissatisfied with the natural status of their race. Melancholy, yet ludicrous, the contemplation of the opposite attempts which we have seen made to deprive that "fairest of her daughters, Eve," of her long-worn honors as "the mother of all living." Thus, there is a theory, we know, which directs us backwards to the fish, and one step lower, to find the embryo of human kind:—*turpiter atrum, desinit in piscem, mulier formosa.*

The speculation we have been considering, on the other hand, is one which so exaggerates the value of varieties of form and color, as to require distinct original progenitors for white men, for the red, and for the black.

Between such conflicting views we rather choose to hold fast by the literal meaning of the Bible, deeming ourselves and all our fellow-creatures *the offspring of God—a little lower than the angels—children of one father—every one members one of another.* T. H. M. B.

Elementary Geology.*

The progress of a national scientific investigation, zealously and faithfully conducted, such as the Geological Survey of Canada, commands a respectful attention from the public, and encourages a spirit of active enquiry and enthusiasm among the youth of

* A Manual of Elementary Geology: or the Ancient Changes of the Earth and its Inhabitants, as illustrated by Geological Monuments. By Sir Charles Lyell, M.A., F.R.S., Fifth Edition, greatly enlarged and illustrated with 750 wood cuts. Boston: Little, Brown & Company, 1855.

the country. "Nothing is plainer to me, from my own experience," says the Rev. Andrew Bell of L'Orignal, "than the fact that there is a gradual breaking down of the prejudices which have been entertained in regard to Geology; and amongst the whole circle of my friends and acquaintances throughout the Province, I have marked a growing desire for information in regard to it."* It frequently happens that accidental circumstances favour in a remarkable manner the prosecution of of this branch of Natural Science, and the excellent vein of knowledge which Mr. Logan says seems to run up the Ottawa, may have its origin in those rich and varied fossiliferous and metamorphic rocks which compose for long distances the opposite banks of that majestic river.

The members of the 'Silurian Society' hold their meetings in the City of Ottawa, almost on the shores of a Lower Silurian Sea; in which the remains of animal and vegetable life are found to lie in inexhaustible abundance and in an exquisite state of preservation. The name of the Society is significant, and when correctly interpreted neither assuming nor pedantic. Out of twelve groups of rock recognized by Geologists, the Silurian group is the oldest but one. It underlies the City of Ottawa, and there exhibits itself in grand precipices and cliffs on the romantic banks of the river. No other fossiliferous rocks but those which belong to the Lower Silurian group, with the exception of the Post-Tertiary have been found near the city, or indeed we believe, between the Ottawa and the St. Lawrence. The object of the Silurian Society then, if we are not misled by its name, is to encourage the study of the Silurian rocks upon which the City of Ottawa is founded; of which its houses, churches, bridges and magnificent locks are built, its public edifices constructed, and its streets paved. In some parts of the huge piles of rock which rise layer upon layer to the height of nearly 200 feet, it is scarcely possible to detach a slab from its bed without revealing the beautiful and delicate forms of Crinoids, Cystydeans, Trilobites, Graptolites and Corals. Many of the fragile Stone-lilies preserve their original form and position with such minuteness, and occur in such countless numbers, as to convey the idea that one is wandering over the bottom of a secluded and tranquil bay in a remote corner of a Silurian Sea, where, undisturbed by winds or waves, the living tenants of the deep suddenly died and turned to stone.

That the 'Silurian Society' may grow in strength and wisdom, is a wish to which all may cordially respond, as well as to the conviction, that with disinterested zeal and diligence it will become the inspiring centre of useful geological investigation in that rich and almost unexplored region which occupies the banks of the Ottawa.

Second, perhaps, in the power of awakening a taste for the pursuit of Natural Science, stand those illustrious individuals who, in addition to profound acquirements, are fortunate enough to possess social and moral excellencies which win the sympathies and affections of their disciples. To what department of Natural Science can we turn and not find the name of the late Professor Edward Forbes associated with its improvement and progress. "Never perhaps," says Sir Charles Lyell in the preface to the fifth edition of his Elementary Geology, just published, "has it been the lot of any Englishman who had not attained to political or literary eminence, more especially one who had not reached his fortieth year, to engage the sympathies of so wide a circle of admirers, and to be so generally mourned. The untimely death of such a teacher was justly felt to be a national loss; for there was a deep conviction in the minds of all who knew him, that genius of so high order, combined with vast acquirements, true independence of character, and so many social and moral excellencies, would have inspired a large portion of the rising generation with kindred enthusiasm for branches of knowledge hitherto neglected in the education of British youth."

Not less influential, though in a narrower sphere than the distinguished professional teacher, with the civilized world as his auditors or readers, stands the enthusiastic amateur student of nature, who pursues with retired and unassuming zeal the investigations which belong to his favourite science. Every country in one form or another has its own Hugh Miller. The force of genius joined with true excellence of character occasionally succeed in elevating everywhere some one to an exalted position in the social scale. "Mr. Telford, like Mr. Miller, followed the profession of a stone-mason before his industry and self-tuition qualified him for the higher functions of an architect and civil engineer; and Mr. Watt and Mr. Rennie rose to wealth and fame without the aid of a university education. But distinguished as these individuals were, none of them possessed those qualities of mind which Mr. Miller has exhibited in his writings; and, with the exception of Burns, the uneducated genius which has done honour to Scotland during the last century has never displayed that mental refinement, and classical taste, and intellectual energy, which mark all the writings of Hugh Miller."*

We do not require to search long or wide for a Canadian Hugh Miller; one not known to the public by his writings or published discoveries, but rather by a most honourable mention in the report of the Director of the Canadian Geological Survey; by a unique collection of palæontological monuments of Silurian age; by unsurpassed mineralogical proofs of the hidden wealth of the Ottawa valley; by a patient and laborious study of Canadian rocks when a Geological Survey of the country was hardly thought of, and by the fact that many of these investigations were carried on, and fossil and mineral treasures discovered and hoarded up, during years of wild and romantic life in the uninhabited parts of Canada and the trackless regions of the Hudson's Bay Company's Territory; trusting to his rod and his gun for the support of life, and, like Hugh Miller, exchanging all day-dreams and amusements for the kind of life in which men "toil every day that they may be enabled to eat, and eat every day that they may be enabled to toil." With the early progress and development of the Geology of Canada, the name of Andrew Dickson will always be honorably associated.

At the present time public attention abroad is especially directed to this country through the remarkable display at the Paris Exhibition of our mineral wealth. The future of Canada is likely to be influenced in a great degree by the encouragement which is given to mining industry, and the care and economy with which all such enterprise is conducted. Perhaps there is no science which can engage the attention of the youth of Canada, with such excellent prospects of utilitarian advantage, as that of Geology. "It is a philosophy which never rests—its law is progress: a point which yesterday was invisible, is its goal to-day, and will be its starting post to-morrow." These considerations induce us to recommend to

* See the Evidence of Mr. Bell before the Select Committee on the Geological Survey of Canada.

* See a sketch of the Life and Writings of Hugh Miller, by Sir David Brewster, in "The Footprints of the Creator."

the careful attention of those who are desirous of making this branch of science a recreative study, the last edition (5th) of Sir Charles Lyell's Elementary Geology, a work which is, unquestionably, the most faithful exposition of the present condition of Geological Science now in print.

Coccothraustes Vespertina.—Evening Grosbeak.

BY THOMAS COTTLE, ESQ.

A notice of the appearance of the *Coccothraustes Vespertina* within the peninsular of Western Canada,—of which Bonaparte says, "few birds could form a more interesting acquisition to the Fauna of any country than this really fine Grosbeak,"—is, I think, of sufficient interest to the Ornithologist to merit a place in *the Canadian Journal*: and would the various observers of nature in different parts of this Province note in the same paper any varieties they may discover, either in the animal or vegetable kingdoms, it would greatly aid the enquiries into its Fauna and Flora.

This bird was little known when the Prince of Musignano wrote his supplement to Wilson's American Ornithology. He says, "The specimen of the Evening Grosbeak presented to the Lyceum of New York by Mr. Schoolcraft, (1823), from which Mr. Cooper established the species, was thought, until lately, to be the only one in the possession of civilized man; but we have since examined two shot early in the spring on the Athabasca Lake, near the Rocky Mountains, and preserved among the endless treasures of Mr. Leadbeater of London." His description of the male is very correct, except that in the four specimens I have examined, there was no white at all on any of the tail feathers or on the quills, the three outer of which he describes as being "inconspicuously tipped with whitish." This might be the difference of age or the incomplete change from winter to summer plumage. The bill he also describes as greenish yellow brighter on the margins, this is the appearance in the dry state and detracts somewhat from the beauty of the head, for when alive it is wholly of an apple green. He also makes a great error in stating:—"No difference of any consequence is observable between the sexes, though it might be said the female is a little less in size and duller in plumage." He evidently had not seen a female, and probably one of Leadbeater's birds, from which he says he took his description, may have been a young male. The sexes differ as much as would naturally be expected in a bird of such bright colours, as will be evident by a glance at the two specimens accompanying this paper. I dissected four birds in the yellow plumage and found them all males, and three in the ash-coloured and found them all females, so there can be no doubt of the plumage of the sexes. Dr. Richardson gives a plate of this bird in his Northern Zoology, which is rather over-coloured.

I first discovered the Evening Grosbeak in a maple wood on the 7th of May, they were very numerous, the flock amounting to at least fifty. The day was very cold for the time of year, and in the evening it began to snow, which lay on the ground during the night; this day and the following they frequented the same wood, since which I have not seen them. They were by no means shy, but on being fired at would fly a short distance and alight again, continually uttering a short monotonous note. Those I killed were excessively fat, their craws and stomachs were distended with the seeds of the maple denuded of the husk.

Description of the Female.—Bill as in the male; irides black; head ash-colour, an indistinct yellowish band passes from the shoulders round the hind part of the head; back, ash, not quite as dark as the head, and with a slight yellowish hue; chin white, bordered by a black line from the angles of the lower bill; belly, pale ash; lesser wing coverts black with the exception of three or four nearest the back, the outer webs of which are white, the under ones yellow; the outer feathers of the greater wing coverts white, the centre and tip broadly black, those nearer the back black, at base and inner web, but the upper half dark ash; the three first quills black, slightly marked with white on the inside, the next four bared with white, the inner webs edged with white; tail coverts black tipped with white; tail feathers black, a large white space on the inner web at the end. A yellowish tinge pervades all those parts of the plumage that are yellow in the male.

Woodstock, June, 1855.

Lubrication—Mineral Oil as a Lubricant for Machinery.

It will be permitted by every one experienced in the working of extensive steam or other machinery, that to obtain a good lubricating material, possessing all the qualities which will render it fit for general useful application, and, above all, a certain degree of cheapness, is a question of considerable difficulty, and often, indeed, one which the practical engineer and machinest finds quite beyond his means of solution. There can be no doubt that certain of the lubricants at present in use possess a character which, considered in respect to especial applications, places them almost out of the the reach of any ordinary substitute; but it must be remembered that these very specialities render such substances unsuitable to general purposes; and it cannot be denied, that any material which is in itself capable of such modifications in process of manufacture as will render it equally suitable to the lubrication of a steam-engine or of the spindles of a cotton-mill, to machinery working with either a high or low degree of speed, is a desideratum in every branch of industry in which mechanical agency is employed. Such qualities as these are claimed for the *mineral oil*, the chemical and physical properties of which we propose to bring under brief review.

When we examine into the question of what the peculiar properties are which it is necessary that a good lubricant should possess, we find the subject dividing itself into two parts—the one relating to the chemical constitution of the lubricating agent, the other to its physical character. With regard to its chemical composition and behaviour, the considerations that present themselves relate, first, to the action of the elements of the lubricating matter, directly or indirectly, upon the metal of which the machine is constructed; and, secondly, to the changes which it may experience in its own constitution by exposure to air or any other influence, as any change in its chemical character produced under such circumstances would, in all probability, immediately affect the question of its lubricating power. Perhaps, in nine-tenths of the cases in which a lubricating medium is employed, at least when the lubricant is in the fluid or semi-fluid state, all the parts of the machinery are composed of metal, either iron, or some form of brass or gun-metal. From this circumstance, it must be at once obvious that the chemical habitudes of the lubricating material towards these metals is a consideration of importance, particularly when the machinery is of a delicate character. It is a very well-known fact, even to those who possess no knowledge of chemical principles or reactions, that when such metals as those named above are exposed to the continued influence of the air, especially if moisture be present, their surface undergoes a peculiar change from the action of the oxygen contained in the atmosphere, with which substance most of the metals can unite, their surface becoming abraded or destroyed as the action progresses. This is termed oxidation.

The power of oxygen to combine with metallic surfaces is very greatly enhanced by the presence of many chemical substances which possess an affinity for the oxide first formed; in that case the production of the oxide will be constantly renewed, and the wear or waste of the metal will be commensurate with the rapidity with which this chemical operation goes on. If, then, a substance possesed in the highest and most perfect degree tho physical characters requisite in a lubricating material, but were at the same time capable of acting in

the manner just described upon the metal itself, it is manifest that it could not be advantageously employed as a lubricant.

Many of the oils and fats which are employed in greasing machinery undergo spontaneously a chemical change which endues them with the power of oxidising metals, particularly copper, and consequently brass, which is an alloy of that metal. Some fatty substances run more quickly into this condition than others, and the change, when it has proceeded far, is sufficiently marked to be at once recognisible on a very cursory examination of the material. This change is popularly known as rancidity: it consists in the spontaneous conversion of the elements of the fatty substance into acids, which differ according to the nature of the material itself, but which have in all cases sufficient affinity for metallic bodies to establish that action upon the surface to which we have already alluded. In some instances the mere contact of the fatty body with a metal is sufficient to effect a change in it which enables it to react secondarily upon the metal itself. An action of this kind may be seen when a bright piece of lead is kept immersed for some time in a vegetable oil, particularly olive oil: the whole surface of the lead in this case will soon be covered with a thin deposit of an unctuous substance, called by chemists margarate of lead; the first action of the lead being to promote the conversion of the margarine contained in the oil into margaric acid, which then reacting upon the lead, produces the substance described. With respect to the chemical changes of the second kind in which the lubricant may be involved, the circumstances are different. There the lubricant may be totally inactive, so far as in its relation to the metal of the machinery is concerned; but, by exposure to air, or from some other influence, it may have been so far chemically changed as to have become thickened or rendered viscid and adhesive, or it might have acquired the property of drying up after a while into a hard, resinous kind of matter: all these changes would, of course, unfit any material for the purposes of lubrication. A certain class of oleagnious bodies have naturally the property of drying when exposed to the air, and many of those which have not naturally this character are rendered thick and tenacious under the combined influence of air and a raised temperature. None of the various materials which are obnoxious to such changes can be placed in the category of the substances suitable to the uses of the practical engineer, except in the very roughest kind of machinery; and even then their employment is equivalent to a certain loss of power in the prime moving force.

From what has now been said, it appears, then, that a perfectly good lubricant should combine these definite chemical and physical qualities:—first, it must be incapable of exercising any chemical action upon the metal exposed to its influence; secondly, it must maintain the integrity of its normal chemical constitution under the influence of heat and atmospheric air; and, thirdly, it must, for fine machinery, possess sufficient unctuosity to enable it to interpose a homogenous medium between the metallic surfaces without flying off, during the rapid motion of any part of the work; while, for heavy machinery, it must, in addition to its freedom from all liability to chemical change, possess that degree of consistency and tenacity which would prevent it from being easily forced out from between moving surfaces by pressure alone. There are few substances which combine these qualities; perhaps those in which they are most conspicuous are sperm oil and the oleine of solid fats: the former may be taken as a standard by which we may judge of the lubricating power of all other fatty materials. Having now, then, in some degree ascertained the points in which the value of a good lubricant consists, we will inquire how far the *mineral oil* can establish its claim to that title.

Some years ago, it was discovered that when the bituminous shales, or schists—which abound in many localities in Europe—are exposed to destructive distillation, they yield a very considerable quantity of a tarry liquid, which, upon re-distillation, furnishes a volatile spirituous fluid resembling coal naptha, and an abundance of oils, boiling at varying but very high temperatures. At a later period it was found that peat would yield, under similar treatment, oils of a very similar character; and, still later, a further source of these oils, in unlimited quantity, has been discovered in the variety of coal, or more properly shale, which has come into extensive use in gas-making under the name of "Boghead coal." The peculiar character of these oils consists in their containing a large quantity of the substance called *paraffine*, which is held in solution by a thin oil of low specific gravity, closely resembling, if not identical with, the oil first described by the Continental chemist Reichenbach under the name of Eupion: this oil, from its containing paraffine, is sometimes called, commercially, "paraffine oil." In distilling the Boghead coal with the object of obtaining the oil, particular regard must be had to the temperature at which the distillation is carried on; for it is a remarkable fact, that the nature of these pyrogenous products varies in an extraordinary manner according to the temperature employed in producing them. In order to obtain the maximum quantity of paraffine oil from the Boghead coal, the heat should not exceed, at any period of the distillation, a dull red, and the process should commence with the lowest temperature at which the tar will distil over. This point being properly attended to, the least quantity of gas and the largest quantity of oil will be obtained: whereas if the temperature rise to a cherry or bright red, the contrary will be the case, as a considerable portion of the oil will be then converted into gas; and not only so, but in the place of paraffine, which is eminently the product of a low temperature, a different substance, napthaline, will be formed, and will, like the paraffine, be held in solution in the fluid oil. In re-distilling the tar to obtain the paraffine oil, the nature of the product varies as the process proceeds: first comes over the thin eupion-like oil, which boils at the lowest temperature: then comes, as the distillation advances, more and more paraffine in admixture with the thin oil, until at length the product solidifies on cooling, in consequence of its consisting almost entirely of paraffine. All these products, excepting the solid paraffine, are said to be excellent as lubricants under peculiar suitable circumstances—this is, with regard to the character of the machinery to which they are employed.

The oils obtained in this process are of very low specific gravity, ranging from ·790 to ·870. Sperm oil being ·875, they are all more or less unctuous to the touch, and at common temperatures are as fixed as any of the organic oils or fats, boiling only at a temperature approaching that at which the ordinary fats undergo partial decomposition, and then distilling over unchanged.

Having now seen how this mineral oil is obtained, the question arises as to the characters and conditions which render it superior to other substances as a lubricant, or indeed whether such is really the case. A glance at the chemical constitution of this oil will perhaps enable us to form an opinion on one part of the subject.

Referring again to the characters of the ordinary fat oils, we shall find that they consist essentially, in all cases, of certain chemical combinations of carbon, hydrogen, and oxygen, the proportions of which vary slightly according to the nature of the oil; but the specific character of oxygenated compounds belongs to all oils and fats of this class. Such being, then, the chemical nature of these substances, it is obvious that in the element oxygen they contain within themselves the principle of oxidation, and that under the influence of an action which, like fermentation, can establish a tendency to chemical change among their own elements, compounds may be formed, acid or otherwise, without the intervention of external agents; and these compounds may, as we have already seen, possess chemical affinities which enable them to attack and enter into combination with any oxidisable metal with which they may be brought in contact.

Independently, too, of the oils commonly employed in lubrication containing oxygen which might be the means of effecting changes such as we have mentioned, they are themselves all more or less susceptible of oxidation from the influence of external agencies, and the moment this oxidation takes place the normal character of the oil is lost. If we turn now to the consideration of the chemical constitution of the "mineral oil," we find that it differs in one very important particular from the oils or fats of organic origin. It contains, in fact, no oxygen, being a compound of two elementary substances only, viz., carbon and hydrogen. This oil belongs, indeed, to an extensive class of compounds, called hydro-carbons; and so entirely free is it from any oxidising tendency or power, that substances having the most energetic affinities for oxygen, and capable of taking it from any matter in which it exists in combination or otherwise, are perfectly protected from that action by being kept immersed in it. Thus, potassium and sodium—metals whose oxidising tendency is so powerful that they can be only preserved in the metallic state with difficulty—can be kept in the mineral oil entirely unacted upon, and maintaining their brilliancy of surface when freshly cut. There is another point to be considered: the hydro-carbons, and the mineral oil among the rest, have not the slightest tendency to combine with oxygen themselves—at least, under any ordinary circumstances. One of their great characteristics appears, indeed, to be an intense internal conservative principle or force which counteracts any liabilty to change among their own elements, and which may be even communicated to organic substances placed under their influence, as many perhaps all, of these substances possess a strong antiseptic power. The substance paraffine,

which enters so largely into the composition of this oil, is perhaps the most inert of chemical compounds: it is quite indifferent to other chemical agents, even of the most powerful kind, and cannot be made to form any combinations with them; hence its name (*parum affinis.*) As these oils are thus chemically exempt, then, from the influence of the agencies to which they are exposed, they are not only preserved from any change which may cause them to act injuriously upon the metals with which they are in contact, but are likewise incapable of experiencing those changes which cause the common oils to thicken and dry. The consequence of this is, that they physically remain unaltered as lubricants during any length of time, as they appear, from some experiments made in connexion with this part of the subject, to be quite insusceptible of drying when exposed upon a non-absorbent surface. The following results were obtained in testing this mineral oil against other oleaginous matters and their mixtures with the mineral oil itself. The trials were made with the Glasgow oil-testing apparatus (M'Naught's).

Sperm oil, taken as a standard	=	100
Mineral oil, the thinnest kind	=	18
Do. do. containing more paraffine	=	30
Olive oil and mineral oil, equal parts	=	48
Lard oil and mineral oil, equal parts	=	54
Do. do. do. 2 parts to 1	=	63
Refined rape oil and mineral oil, equal parts ...	=	56

A Reply to an Article in the June Number of the Canadian Journal,

AND ENTITLED

"*Report of the Select Committee on the Geological Survey of Canada. Minutes of Evidence.*"

BY E. J. CHAPMAN, PROFESSOR OF MINERALOGY AND GEOLOGY IN UNIVERSITY COLLEGE, TORONTO.

[We should have been glad to have afforded the following communication from Professor Chapman a more prominent place in this number of the *Journal;* having, however, received the MS. after the first two sheets were struck off, no alternative remained but to submit it in its present place. We allow the "reply" to pass without any allusion to the admission into these pages of the offending parts of the review; the argument which Professor Chapman has preferred to adopt in his defence, rendering any reference to it altogether unnecessary. We have merely to remind Professor Chapman and his so-called "anonymous assailant," that no renewal of the discussion can take place in the pages of this *Journal.*]—Ed.

In the last number of the *Canadian Journal* there appeared an anonymous article, purporting to be a review of the "Minutes of Evidence" in the case of the late inquiry respecting the Geological Survey question, at Quebec. This article, it must be evident to every unprejudiced reader, is little else than a direct attack upon my professional reputation and character. The quotations from my evidences, disjointed, partially given, and taken out of place; the italics and notes of admiration; and above all, the gratuitous and most unwarrantable assumptions, so largely indulged in by the anonymous writer—are sufficient proofs of the justness of my assertion. It is to be regretted for the sake of truthfulness and fair play, that an opportunity was not afforded me to print my answer simultaneously with the attack, as the latter may be read by many persons before whom the reply may never come.

The matters commented upon by my anonymous assailant, belong, I believe, almost entirely to Questions 44, 55, 47, and 54, of the Minutes of Evidence. I will take up these separately, and in the order adopted in the Journal.

"*Question* 44. Have you ever been practically engaged in any Geological Surveys?—*Answer.* Yes, in several: principally for Railway and Water Companies. I have also taken part in Mining surveys; and I may mention, as lending more weight to my evidence on this occasion, that I am the author of several works on Mineralogy, and of a considerable number of published papers on Mineralogy, Mineral Chemistry, and Geology, many of which have been translated into foreign scientific Journals. For three years, likewise, I was a Professor in University College, London."

The last sentence is omitted in the Journal Report, and the words "for Railway and Water Companies" are in italics. The writer then observes in continuation, "We may perhaps be permitted to question whether the implied comparison* between a geological survey for "Railway and Water Companies and the Geological Survey of Canada —a vast country containing 300,000 square miles—is either philosophical or just; a doubt which is far from being dispelled by the perusal of the question and answer subjoined, &c." This question and answer, No. 55, I will take up presently, merely remarking here, that in the Journal Report only a portion of the answer is given, to the obvious detriment of its value. Now, what was the object of the Committee in putting the above question, No. 44? Evidently to ascertain if I were sufficiently acquainted with the practice of geological field-work to enable me to form a just opinion of the general mode of conducting the present survey, taking, of course, into consideration the difference between an old and new country. That such was, manifestly, the object of the question, is shown by those which immediately follow in the Minutes. My anonymous assailant, so prodigal of inverted commas, does not appear to have the faintest conception of the kind of work involved in a geological examination for railway purposes in a country, for instance, like England, where so many distinct zones of rock may cross and recross a projected line, again and again, within a very contracted area. I do not hesitate to say, that limited as this kind of work may be, it exacts a greater degree of skill and judgment for its successful execution, than is required in many an ordinary survey, in which lines can be traced out and connected from distant points. We have here, broken patches, often repeated upon themselves, in which the exact sequence, dip, thickness, &c., have to be made out, frequently, from the most imperfect data.† A geological survey for a "Water Company" need not also be so small a matter as my anonymous assailant would have people to suppose. When I state, that on one occasion I had the getting up of a geological work of this kind extending over between two and three thousand square miles, I think it may be allowed that I am at least entitled to give an opinion respecting geological field-work without necessarily laying myself open for so doing to foolish and perverse criticisms. Surely, it must strike us also, that the chairman and members of the Committee exhibited great lack of judgment or great forbearance, if my answer to this, their first question, were so conclusive of incompetency as this anonymous writer would have us to infer, in wasting the remainder of the morning by continuing my examination. The thing speaks for itself.

Let us now revert to the second question of the Journal Report, the 13th question of my Evidence, No. 55.

I was here asked if I could "give instances from my own experience in geological surveys of the practical importance of results which at first sight might appear to be exclusively of scientific interest." This question I could only answer generally, and I will say, without fear of contradiction from any honest critic, that there are many able geologists constantly engaged in practical investigations, who could do no more. It must be obvious, that these peculiar instances, taken in a special point of view, are necessarily of rare occurrence; more especially in countries like England and France, where so much is already known. I gave in reply one or two cases of a practical character, which suggested themselves to me at the time, somewhat bearing on the question at issue; and it is with these that the anonymous reviewer pretends to be particularly amused.‡ Now, these cases certainly did not appear to be so very absurd to the chairman and members of the Committee, nor to Mr. Logan and Professor Hall, of Albany, who were in the room whilst I gave my evidence. Indeed, at the close of this evidence, and on more than one occasion since, Mr. Logan was kind enough to express himself fully satisfied—not to use other terms which

* Query—implied by whom? certainly not by the witness. He is here, be it observed, answering a straightforward question put to him by the Committee, and making no comparison whatever. The manifest object of the question is pointed out further on.

† In illustration I might quote, amongst others, a complicated piece of work in Wiltshire and Somersetshire, performed by me in the place of Mr. Wm. Fronde. No less than eight distinct geological formations here came under review, in great part in a broken and much disturbed country. It was on one of Mr. Brunel's lines.

‡ He states—I quote from the Journal—"Mr. Chapman was asked to give instances from his "own experience in such surveys of the practical importance of results which at first sight might appear to be exclusively of scientific interest," and with commendable candour he limited his instances to those which had come under his independent observation, &c." Why, in the name of decency, what would this person have, with his "commendable candour!"

might lay me open to a charge of self-laudation—with my replies. Were Mr. Logan now in Canada, I am quite sure that he would give me such a testimonial as would refute in itself to the full, these unworthy attacks. One thing at least must strike us as rather curious, if we be inclined to adopt the conclusions of my anonymous assailant. How came it, I would ask, that, after I made this lamentable exhibition of myself at Quebec, Mr. Logan was so wanting in judgment as actually to request me to undertake in his name, on account of the survey, a geological inquiry into the pretended occurrence of coal in this part of the country. The inquiry, as things turned out, was certainly not a very difficult one; but that has nothing to do with the question. The bare fact of my having been asked to undertake it, is a sufficient recognition of my capability by Mr. Logan; more especially when he subsequently had the kindness to declare himself well pleased with the manner in which I performed his commission. I trust that I may not be accused here of egotism; but, even at that risk, I am induced to bring this matter prominently forward, as a direct answer to the anonymous imputations attempted to be cast upon me. I stated above, that only a portion of my reply to the question at issue, No. 55, was given, I now take the liberty to subjoin the remainder:—

"The study of organic remains, again, is sometimes thought by persons unacquainted with the whole bearings of the question, to have little or no connexion with the practical applications of Geology; but this is altogether an erroneous conclusion. Fossils or organic remains have a two-fold value; first, in revealing to us the history of past creations, and many of the physical changes which our Planet has gone through: and, secondly, in enabling us to determine the relative position of rock groups; each group, within certain limits, holding its own peculiar forms. Now, it is well known that certain economic products are confined over wide areas, either wholly or principally, to certain rocks. To fix the exact positions of these rocks, therefore, in the entire series of strata, becomes a problem of the highest importance, and one, it may be safely affirmed, that in nine cases out of ten, can only be solved by the study of organic remains. In North America, for instance, we have many bands of rock stretching far and wide across the continent. One of these is remarkable for its richness in brine springs and gypsum beds; and by the fossil forms in the bands above and below this, it can be ascertained at points far distant from one another, if we be above or below, near or distant from, the salt and gypsum yielding rock; whereas, if mineral characters alone were attended to, no reliance could be put on any decisions of the kind. In like manner, the position of the Mountain limestone, so rich in many countries in veins of lead ore, of the coal-bearing rocks, again, and of all the other rocks in the series, however closely resembling one another in structure and mineral composition, can be determined with perfect confidence if sufficient Palæontological data be afforded. We thus see that a study apparently only of scientific value, and one worked out in the first instance by scientific researches, has become of the highest importance in a purely practical point of view. In England, as in all other countries indeed, many striking examples may be found of what the study of organic remains has effected for practical science. In rocks far beneath the coal measures, as well as in others far above them, I have seen old shafts, for instance, which must have swallowed up thousands of pounds, still remaining as memorials of futile researches after coal, before geology was prosecuted as a science."

The next question adverted to by my anonymous assailant, is Question 47 of the Minutes of Evidence. In his remarks on my answer to this question, he betrays in a remarkable manner either the greatest obtuseness, or a degree of uncharitableness that no law of criticism can excuse. My character for veracity is here seriously impeached, and in the most wanton manner. The question runs as follows:—

"47. Have you had an opportunity of ascertaining the progress that has been made in the Geological Survey of this Province; and what is your opinion of that progress?—*Ans.* I have devoted several days to a very careful examination of the work already performed, and the materials collected under Mr. Logan's direction; and I can only express my wonder that so much should have been done; considering more especially the small means hitherto at Mr. Logan's disposal, the want of Topographical maps, and other difficulties incidental to a new country."

To this the anonymous reviewer appends the following remarks:—"No one would suppose that a just appreciation of the value of the results already obtained by the survey, could be derived from an inspection even during broad day-light of the minerals collected, as they may have been obtained from localities commercially inaccessible; but, when they "lie in a great measure, buried in packing-cases in the vaults and sheds of the Survey Office, (see Report of Committee) the difficulty is proportionately increased. It is only by a study of the published reports of the work already done, that correct impressions can be obtained of the real value of the Survey. We confess, therefore, to some degree of surprise at finding Mr. Chapman state in the continuation of his evidence, that "several of Mr. Logan's valuable reports, moreover, are out of print, and *I have been quite unable to obtain copies of them.*"

Answering the last allusion first, I may observe that it is one thing not to be able to obtain copies of these Reports, and another not to have seen them.* It was in answer to quite a different question (No. 49) that I expressed the desirableness of having these Reports revised and republished in a single volume; and to show how scarce they had become, I stated my inability to procure copies of several of them. But what has this to do with my appreciation of Mr. Logan's labours? All of the Reports were at my disposal at Montreal; and, if I be not greatly mistaken, we had them with us in the waiting-room attached to the committee-room at Quebec.

The main question here turns, however, on my ability to speak to the value of the actual labours and achievements of the Survey. "No one," says the sagacious reviewer, "would suppose that a just appreciation of the results already obtained by the Survey, could be derived from an inspection even during broad day-light, of the minerals collected, as they may have been obtained from localities commercially inaccessible; but, when they lie in a great measure buried in packing-cases in the vaults and sheds of the Survey Office, the difficulty is proportionately increased." From whence did the anonymous reviewer derive his authority that my appreciation of the value of the Survey was drawn from this source? He would here manifestly imply that I had given false evidence, or what is the same thing, that I had borne testimony to the value of the Survey without knowing anything that had been done upon it.

I feel, certainly, a keen sense of degradation in being obliged to reply at all to such a charge. But how did I obtain my knowledge? Simply thus, by a close and laborious examination of plans, sections, field-books, and other documents, both published and unpublished, laid before me, and carefully and minutely explained by Mr. Logan in person. If it be any satisfaction to my assailant, I am not too conceited to confess, that I gleaned a rich harvest of geological facts, apart from those more especially belonging to our subject of inquiry. Such, then, —not omitting also a general examination of a large portion of the materials collected on the Survey, and at that time under process of arrangement in different rooms belonging to the Museum—was the way in which my knowledge was obtained. If we add to this my acquaintance with the mode of procedure adopted on the Geological Survey of Great Britain (see my answers to Questions 45 and 46, and part of Mr. Logan's answer to Question 70), it must be evident to every impartial person that I was perfectly qualified to reply on these points to the inquiries of the Committee.

My anonymous assailant then proceeds to a discussion of my answer to Question 54. He says:—

"Mr. Chapman is asked by the Committee to state some of the new Scientific Truths which have been derived from the Survey, and he enumerated among others the following:—"Another very interesting discovery is that of the crustacean tracks on the Potsdam Sandstone. The celebrated discussion to which this has given rise in England has attracted the attention of scientific men all over Europe to the results of the Survey." Had Mr. Chapman enjoyed the opportunity of studying Mr. Logan's admirable Report for 1851 and '52 he would have known the name and designation of the real discoverer; or had he met with the fourth edition (1852) of Sir Charles Lyell's Manual of Elementary Geology he would have found the following circumstantial notice of the "tracks," with the date of the discovery, and thus avoided leading the Committee into error on a subject familiar to every amateur geologist in Canada."

Here follows the quotation from Lyell's book, with the accompanying remarks at its close:—"We may here remark that Professor Owen first inferred (1851) that the tracks were those of a fresh water or estuary tortoise. Agassiz supposed that they were crustacean, in

* In illustration of this, one would think, self-evident assertion, I may remark, that before I left England I procured a copy of the second volume of Hall's Palæontology of New York, and that I am still trying, but without success, to get a copy of the first volume. At the same time we have the work in our College Library; so that without actually possessing it I have become perfectly familiar with its contents.

which view Professor Owen coincided in 1853." (See Journal of the Geological Society, August, 1853.)

Here, then, I am accused of ignorance, and leading the Committee into error. First, as to the ignorance. A complete and circumstantial history of these fossil tracks was given to me personally in England by Mr. Logan, on one of the few occasions on which I was in his society before I came to Canada; and as to the edition of Lyell's Manual, in which an account, though by no means a complete one, of these tracks is given, I happen, unfortunately for the argument, to possess from accidental circumstances no less than a couple of copies. Besides which, on more than one occasion, I have publicly referred in my lectures to the various points connected with this discovery. But when persons are so exceedingly hypercritical, surely they should be exact also. Now, the truth is, Mr. Abraham, although the announcer, was not the real discoverer of these tracks. They were first detected by a miller residing near the spot; and the discovery being brought by this miller, (whose name science unjustly ignores), or by some of his neighbours, under the notice of Mr. Abraham, that gentleman published an account of the matter in the *Montreal Gazette*. Mr. Logan then took up the subject, and pointed out certain geological errors into which Mr. Abraham had fallen. Again, the second and correct determination of the nature of these tracks was made by Owen, not in 1853 as incorrectly stated, but in the early part of 1852. Although dates in scientific matters are serious things, I should scarcely have thought it worth while to notice this error, were it not to show in its true light the ridiculous parade of erudition here brought against me.

Secondly, I am accused of misleading the Committee. But let us see how the case actually stands. I am asked by the Committee, as to the *establishment of new scientific truths* (the italics are my own) in reference to the labours of the survey. Now, I will maintain that the "establishment" of this discovery as a new scientific truth is entirely due to the exertions of Mr. Logan. If the survey had not been instituted at the time, one of two things must inevitably have followed: the discovery would have been a ten days' wonder, and then passed out of mind; or, it would have been taken up by some of our scientific neighbours, and the merits of its further developement thus lost to Canadian geology. In 1851, Mr. Logan laid before the Geological Society of London, a large slab of the rock containing these tracks, together with a series of casts relating to the same, and a minute account of their occurrence. In 1852 he again crossed the Atlantic with further casts and more ample particulars, and thus led to the determination by Professor Owen, with whom Mr. Logan put himself in immediate communication, of the true nature of the animals by which these tracks were made. If, after this, the Geological Survey of Canada may not claim the merit of "establishing" the discovery as a scientific truth—and, be it remembered, I spoke to nothing more—with whom, I would ask, in the name of justice, does the merit lie?

But to place my position fairly before the reader, the entire question and answer should be given.

"54. The results to be expected from a Geological Survey being two-fold; the establishment of new Scientific truths, and the discovery of facts and materials of Economic application, can you state to the Committee some of the advantages in both of these branches, which have been already derived from the Survey, and may be expected from its future extension?—*Ans.* With regard to Economic discoveries, I may state generally, that the Survey has brought to light the existence of beds of workable Peat, before, I believe, unknown in Canada, or at least undescribed: of Slate of excellent quality, of Limestone bands, where Limestone was supposed to be absent, and of Lithographic stone, Serpentine, Soapstone, White brick clay, and other valuable materials, previously altogether unknown or undiscovered, along the localities indicated by the Survey; it should also be remembered in an enquiry of this kind, that *positive* discoveries are not the only facts of importance to be made known, *negative* results being in many instances almost equally valuable. Of this latter class, the proof of the non-existence of Coal over the greater part if not the whole of Canada, is entirely due to the Survey; whose labours have thus put a stop to much useless expenditure of money in futile researches after that mineral. Looking at the Survey again, in a Scientific point of view, we find it elaborating many facts of the highest interest, some of which, I do not hesitate to say, may take rank with anything made known of late years by European Science. The discovery of Phosphate of Lime as the chief component of certain shells, is a striking case in point. It was long considered as a settled fact that the Chemical composition of the bones and teeth of vertebrated animals differed entirely from that of the shells and hard parts of the lower classes of the animal kingdom: consisting in the former essentially of phosphate, and in the latter, of carbonate of lime. This fancied difference has been broken down so far as regards certain brachiopods, by the chemical researches of the survey; a discovery which will, no doubt lead to important deductions. Another very interesting discovery is that of the crustacean tracks on the Potsdam sandstone. The celebrated discussion, to which this has given rise in England, has attracted the attention of scientific men, all over Europe, to the results of the survey. Several new minerals have likewise been discovered, and errors have been rectified in regard to species long known. A great deal of light has also been thrown on the complicated question of the metamorphism of rocks, and from the investigations now being carried on, both by Mr. Logan and Mr. Hunt, much more may be shortly expected. There can be no doubt also, that when the complete investigation of our Canadian rocks is accomplished, so far as to justify minute comparison with rocks of the same age in the United States and Europe, many important generalisations will be arrived at, leading in the end to a revised grouping and nomenclature. Finally, it should be borne in mind, that the chief attention of the survey has been hitherto bestowed on economic questions, the scientific investigation of the geology of the Province having been made in a great degree subservient to these. As the survey progresses therefore, its science will be necessarily more fully developed."

Alluding, towards the close of his attack, to the first part of the above answer, my anonymous assailant affects great indignation at the omission of certain economic substances from my list;* although it will be seen I stated to the Committee that I spoke in general terms, and also that the phrase "and other valuable materials" occurs at the end of my enumeration. It was at the same time distinctly understood in the committee-room that the question of economics was to be taken up in full by Mr. Logan, and hence the comparative brevity of my reply. The "serpentine" and "soapstone", and the "bringing to light the existence of valuable beds of peat," seem, from their inverted commas, to be thought fair game for the critic's irony. But what do we find, in relation to these matters, in Mr. Logan's evidence, given the day after mine. I quote from that gentleman's answer to question 89:—

"Soapstone is a material pointed out as existing in abundance. There are many establishments in the States whose business is devoted to the manufacture of it alone, and the Canadian localities are coming into operation. From what we have reported of peat and from the dearness of domestic fuel, a person in Montreal has commenced preparing and selling it for house use, at \$5 per cord of 128 cubic feet unpressed, and \$12½ for the same bulk pressed. He tells me that braziers and blacksmiths have been using some of it to their satisfaction, and I am aware that some enquiry has been making about it for the smelting of iron. It is used for such a purpose in France and other countries. It is known that 40,000 people are employed in France in the preparation of peat in various ways."

The serpentine, white-brick clay, &c., are spoken of in other answers. Here then, I have at least the satisfaction to know, that if my reference to the peat have anything ridiculous about it, Mr. Logan has kindly placed himself in a similar dilemma.

In conclusion, I would observe, that a mode of assault commonly followed in hostile criticism, is first to ferret out errors or imperfections in the subject-matter—or to create such, if they chance to exist only in the wish or distorted imagination of the critic—and then to base on these real or imaginary shortcomings, a system of inferences, worked out in a sarcastic spirit with a view to irritate the feelings or affect the reputation of the writer. This latter element constitutes the main part of the attack upon me in the anonymous article admitted into the last number of our Journal; and it must be evident to the impartial reader, that if I were disposed to retaliate in a similar spirit, I have abundance of materials at command to enable me to do so with success. In my reply, I have necessarily limited myself as closely as possible, to a bare refutation of the charges and insinuations brought against me. I have thus shewn:—

First, that my past labors in practical geology, although certainly not comprising a survey of 300,000 square miles, have been amply sufficient to enable me to give legitimate evidence on the working of our Canadian Survey, on the best means of bringing its results before the country, and on the future requirements of Mr. Logan's staff.

Secondly, that after a good opportunity, during my constant inter-

* These, it will be noticed, he gleans from an answer in Mr, Logan's evidence.

course with him at Quebec, of testing my fitness or unfitness, Mr. Logan did not hesitate to request me to perform in his name, a geological examination; and that he has expressed himself perfectly satisfied with the manner in which I conducted it.

Thirdly, that my evidence in relation to the amount, &c., of work already performed by the survey, was not derived from "an inspection of packing cases buried in the vaults of the survey office"—as gratuitously inferred by my anonymous assailant—but amongst other sources, from a careful examiuation of published and unpublished documents in great numbers, placed in my hands by Mr. Logan, and elaborately explained by that gentleman in person.

And, lastly, that with regard to the establishment as a scientific truth" of the deductions flowing from the "Postdam-sandstone tracks," my evidence before the Committee, is fully borne out by what I have said above. The tracks were not in the first instance actually discovered by Mr. Abraham, as erroneously stated in the Journal; and, allowing all praise to that gentleman for his investigation and announcement of the matter, I put it to every lover of fair-play, if, without the interference of the survey, without Mr. Logan's exertions the merit of the discovery would not have incurred the greatest risk of being lost to British science. I can only say that amongst scieutific men, no one questions for a moment to whom the credit belongs.

These facts established, I may pass, without reply, the pseudo-facetious remarks and attempts at witticism indulged in by my anonymous critic. They would be harmless enough, indeed, in themselves, were it not for the too-evident prejudice to which I find it difficult to avoid tracing their origin.

The Great Court in the Crystal Palace at Sydenham.

Passing on from the Niobe, the visitor runs an almost painful gauntlet between a row of objects, among which it is almost as difficult to advauce as to halt. He pauses before the statue of Antinous, so much more divine than his attendant Genius; pores over small bas-reliefs of dancing figures—each a fountain of living art in itself—lingers entranced before that heavenly apparition in a halo of transparent drapery, who is descending, or condescending, to the sleeping Endymion; glances along a wall hung with morsels and fragments to which history can give no name, and for which art needs none; tracing in each that school from which modern Italy drew her inspiratiou, and when in its refined decorum—the only morality of art—was purposely fitted to guide the purity, the fervour, and the ignorance of Christiau art; nay, in some cases identifying the very forms which have served as models: here, a figure all fluttering with heavenly speed, which, transposed by a Christian hand, became an announcing angel; and there, graceful maidens with musical instruments, who need but wings to convert them into adoring Seraphim.

It is here with the eye saturated with beauty, that something like justice can be done to our matchless Elgin marbles. No matter how the taste may have risen with what it feeds on, Phidias still stands on a pinnacle above it. There lie those Fates—or whatever these figures may represent—like petrifactions of a higher order of beings, headless, armless, footless, yet with that plenitude of grandeur iu their rich ample laps which alike defies annihilation and analysis. Happy the artist, and modest and wise, who can study these unrivalled remains; mark their strength and glory, their truth and delicacy—follow the magical rendering of the form, trace the exquisite flow of the drapery, and so far forget all thoughts of self as to return home with inspiration in his heart and not despair.

Classification of the Different Varieties of Canadian Woods, Specimens whereof form the Canadian Collection for the Paris Exhibition.

1° MAGNOLIACEÆ.

White wood, so called in this country, (Liriodendron tulipifera. Linn.)

2° TILIACEÆ.

Bass-wood. (Tilia Americana. Linnée.)

3° ANACARDIACEÆ.

Sumac. (Rhus typhina, Linnée.)

4° ACERACEÆ.

Sugar maple. (Acer sacchariunm Linnée.)
Rock maple, " "
Curled maple " "
Birds-eye maple, " "
Soft maple. (Acer dasycarpum. Ehrhart.)

5° AMYGDALEÆ.

Wild yellow plum. Prunus Americana. Marshall.)
Red cherry. (Cerasus Pennsylvanica. Loisel.)
Black cherry. (Cerasus serotina. De Candolle.)
Choke cherry. (Cerasus Virginiana. De Candolle.)

6° CORNACEÆ.

Cornel, flowering dogwood. (Cornus Florida. Linnée)

7° POMACEÆ.

Dotted or Apple Thorn. (Cratægus punctata. Jacquin.)
Red Thorn. (Cratægus coccinea. Linnée.)
White Thorn. (Cratægus crus Galli. Linnée.)
Mountain Ash. (Pyrus Americana. De Candolle.)
June or Service berry. (Amelanchier Canadensis. Torrey and Gray.)

8° FRAXINEÆ.

White Ash, (Fraxinus Americana. Linn.)
Black Ash, (Fraxinus Sambucifolia. Lambert.)
Rock Ash, (Fraxinus Pubescens. Walter.)
Rim Ash, Fraxinus Juglandifolia. Lambert.)

9° LAURACEÆ.

Sassafras, (Sassafras Officinale. Von Esenbeck.)

10° ULMACEÆ.

White Elm, (Ulmus Americana. Linn.)
Red or Slippery Elm, (Ulmus Fulva. Michaux.)
Rock Elm, (Ulmus Racemosa. Thomas.)
Gray Elm, (" ")

11° JUGLANDACEÆ.

Butternut, (Juglans Cinerea. Linn.)
Black Walnut, (Juglans Nigra, Liun.)
Soft Walnut.
Sheil bark Hickory, (Carya Alba. Nuttal.)
Smooth bark Hickory, (" Tormentosa. Nuttal.)
Pignut, (" Glabra. Torney.)
Bitternut, (" Amara. Nuttal.)

12° CUPULIFEREÆ.

White Oak, (Quercus Alba. Linn.)
Swamp White Oak, (" Bicolor. Willd.)
Red Oak, (" Rubra. Linn.)
Black Oak, (" Nigra. Linn.)
Chesnut, (Castanea Vesca. Linn.)
White Beech, (Fagus Ferruginea. Aiton.)
Blue Beech, Horn-Beam, (Carpinus Americana. Michaux.)
Iron Wood, (Ostrya Virginica. Willd.)

13° BETULACEÆ.

Paper or Canoe Birch, (Betula Papyracea. Aiton.
Yellow Birch, (" Excelsa. Aiton.)
Cherry Birch, (" Lenta. Linn.)
Black Birch, (" Nigra. Linn.)
Alder, (Alnus Incana. Willd.)

14° SALICACEÆ.

Black Willow, (Salix Nigra. Marshall.)
Aspen Poplar, (Populus Tremuloïdes. Michaux.)
Large-Toothed Aspen, (" Grandidentata. Michaux.)
Balm of Gilead, (" Balsamifera. Linn.)
Cotton Wood, Necklace Poplar, (Populus Monilifera. Aiton.)

15° PLANTANACEÆ.

Button-Wood, American Sycamore, (Plantanus Occidentalis. Linn.)

16° CONIFEREÆ.

Pitch Pine, (Pinus Rigida. Miller.)
Red Pine, (" Resinosa. Aiton.
Yellow Pine, (" Mitis. Michaux.)
White or Weymouth Pine, (Pinus Strobus. Linn.)
Balsam Fir, (Abies Balsamea. Marshall.)
Hemlock Spruce, (" Canadensis. Michaux.)
White Spruce, (" alba. Michaux.)
Black Spruce, (" nigra. Poiret.)
American Larch, Tamarack, Larix Americana. Michaux.)
White Cedar, (Thuya occidentalis. Linn.)
Red Cedar, Savin, (Juniperus Virginiana. Linn.)

These woods are found in abundance in all our forests, with very few exceptions; they are, with respect to the soil proper to each, subject to the same conditions as in other countries. The only remark of a general nature which we may here make is, that the families of *juglandaceæ* and *cupuliferea* are more particularly the produce of the Western section of the Province, while those of the *coniferea* and *aceraceæ* are more particularly that of the Eastern section.—*Off. Report.*

The Eruption of Vesuvius.

Prof. Palmieri, of the Observatory of Naples, has made a valuable Report on the Eruption. It appears that the needles of the apparatus of Lamont, which had been slightly affected on the 29th of April, were greatly agitated on the 30th; and on the following day the eruption broke out. No fewer than ten craters opened in the course of a few hours, followed by many smaller ones, all throwing out lava and heated stones, accompanied by subterranean thunders and ruddy masses of smoke. These streams, descending into the plain, called the "Atrio del Cavallo," formed there a sea of fire, whose shores were on either side the Mountain of Somma and the lava of 1850. The materials which formed this sea, swelling from moment to moment, at length poured into the "Fosso della Vetrana," forming a wonderful cascade. The enormous quantity of lava, ever increasing, filled up the valley at the back of the Hermitage; and pouring into the "Fosso del Favaone," formed another cascade, and rolled down in the direction of several townships in the valley. Early in the progress of the eruption, the lava was 100 palms in depth; and it was considered that if another such an accumulation took place, which certainly has now happened, the Hermitage and the Observatory would be in danger. In fact, they have been vacated, and the instruments removed. The precise number of craters it will be impossible to determine till all is tranquil. The same may be said of the materials ejected; though we have observed chloride of iron, gaseous matter destructive to life, and muriatic acid gas.

The magnetic apparatus of Lamont was used by Prof. Palmieri on the occasion of the earthquake of Melfi; and the results were such as to induce him to think that it would not be mute, as the event has proved, on the occasion of an eruption of a volcano. Anticipating, as it had done, such a catastrophe by several days, it is one of the most beautiful and convincing proofs of the practical applicability of science to the service of human beings that modern days has furnished us with. How many lives might have been saved,—how many may yet be saved by the needles of Lamont!

Passing from magnetism to electricity, Prof. Palmieri says, that on the first day of the eruption observations were impossible; but on the clouds clearing off, he ascertained that there was a great tension of positive electricity, which increased considerably on the fall of some ashes on the evening of the 2nd inst. In general, the electricity was always stronger when the wind blew towards the Observatory. It manifested itself very vigorously to the moveable conductor, not always to the fixed conductor; "and during the fall of the ashes," he says, "I verified a curious fact, which I have observed during the fall of rain, also, that whilst with the moveable conductor we had positive electricity, with the fixed conductor a faint, negative electricity was observed." During the course of the greater quantity of lava in the "Fosso della Vetrana," on the north of the Observatory, the thermometer stood 8° higher than on the opposite side of the building.

The lava, after falling into the Fosso del Favaone, progressed from that point as from the apex of an angle, in two directions,—one being down on the townships Cercola, St. Sebastiano, and Massa di Somma; the other, at a later period, in the direction of St. Giorgio a Cremano, and St. Jovio, close to Portici. The first branch being the earliest in order of time, was, when I saw it, 3,850 palms from Cercola, on the next day it advanced 500 plams more, and there it has remained almost stationary; whilst during the last ten days the mountain has been pouring down its greatest fury by the other branch towards St. Jovio. The branch in the direction of Cercola was pent within the deep blanks of a wide bed, and was flowing down, not like a fluid, which is the ordinary motion of it, but like a mountain of coke, or at times like highly gaseous coal. It split, and crackled, and sparkled, and smoked and flamed up, and ever moved on in one vast compact body. Pieces detaching themselves rolled down, leaving behind a fierce glare; and as every mass fell down with the noise of thunder, or rolled sideways from the upper surface into the gardens and vineyard yards, the trees flamed up, and the crowds uttered shouts of admiration and regret.

Following the course of the stream, or rather tracing it back to its source, we walked by the side of that huge leviathan, through highly-cultivated ground, now trodden under the feet of multitudes, until we arrived at the edge of a precipice, whence we looked into the boiling flood, fed by the cascade of lava, which was pouring down from above. Full 1,000 feet fell that glowing, flaming Niagara, in one unbroken sheet, over the precipice at the back of the Hermitage and the Observatory. There were times when projections in the face of the lava seemed to impede its course, or when the adhesive character of it appeared to bind it up in a temporary rigidity; then, behind those projections, accumulated tons upon tons of material. It was a moment of breathless expectation:—all eyes were fixed upon that one blackened spot. There was a slight movement:—one heard a click; a few ashes and stones fell down like *avant-courriers*, and down went a mountain of solid fire into the boiling, smoking abyss, with the noise of thunder. The heat and the glare of light were at such times almost insufferable. The branch on the right, which has since flowed down to St. Jovio, in the direction of Portici, was there only an infant rivulet, stealing on its insidious course through a wood of chesnut-trees and wrapping them all in flame. Alas! how much injury has it since occasioned,—how many trees teeming with the promise of fruit and the grape has it laid low,—how much land has it covered with tons and tons of scoriæ, whereon nothing more will grow for a century but the hardy cactus. In some places a hundred, in others two or three hundred, and in one place a thousand feet in width, it rises to the height of one or two hundred feet, and even more, and has progressed eight or nine miles in the face of five or six flourishing and populous villages in the plain. From St. Jovio the summer residents have fled, and taken their furniture with them. At Cercola and Massa, at the termination of the other branch, a bridge has been cut away so as not to impede the free course of the lava; several houses have been removed for the same reason, and several have been either swept entirely away or half surrounded. In this state things remained till Sunday last; a kind of armistice had been established between the mountain, on the one hand,—and the Saints, Ferdinand the Second, the bones of St. Rocco, and the cardinal, on the other. On Sunday last, however, above all other days, the mountain broke the armistice, and the lava has been galloping, not flowing, down ever since. As it flows, however, over the hardened lava of last week, the danger is not imminent, but if it continues, woe to Cercola and Massa. In the St. Jovio direction it does not flow. Again the interest is reviving; Vesuvius presents a more magnificent spectacle than ever, and crowds still throng the best points of view at night, or run down to the mountain.—*Athenæum.*

University College, London.—The Council have received notice of the resignation by Mr. Graham of the Professorship of Chemistry, in consequence of his having received the appointment of Master of the Mint. The resignation was accepted, with regret at the loss to the college of Mr. Graham's valuable services. At the same session announcement was made of the following additions to the property of the college:—The Parliamentary library of the late Joseph Hume Esq., bequeathed by him to the college; the collection of fossils, presented to the college by the late G. B. Greenough, Esq., with a presentation copy of Mr. Greenough's *Physical and Geological map of India;* and the portrait of Harvey, by Mirevelt, a *chef d'œuvre*, bequeathed to the college by the late George Field, Esq., of Isleworth. Proceedings of a former session were confirmed, as follows:—The appointment of Professor Jenner to be physician to the hospital, instead of assistant-physician; of Dr. Thomas Snow Beck and Dr. John Russell Reynolds to be substitutes, each for six months, for Dr. Jenner, as assistant-physician to the hospital for the year during which Dr. Jenner is charged with the duties of Dr. Parkes as physician to the hospital, and special Professor of Clinical Medicine; the appointment of John Dowson, Esq., to be Professor of Hindostanee, with liberty to teach Telugu, until further arrangements shall be made. The Professorship of Bengalee, offered to William Adam, Esq., having been declined by him, proceedings for procuring instruction in that language, as well as in Tamyl and other Indian languages, were postponed. Dr. Hoffman, Chemist to the Museum of Practical Geology, has been appointed to the office of Assayer to the Mint, left vacant by the elevation of Professor Graham.

To Correspondents.

We beg to remind those of our correspondents who have kindly forwarded for publication various communications relating to public or private interests, that it is not desirable that the *Canadian Journal* should be made the medium of bringing into notice any facts or fancies which may give rise to unprofitable discussion, or to which the writer would object, from personal considerations, to subscribe his name. —Ed.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—May, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Vel'y	Rain in Inch.	Snow in Inch.
1	29·608	29·686	29·763	29·693	51°·0	68°·2	54°·6	57°·3	+10°·9	0·335	0·433	0·308	0·350	·91	·64	·73	·76	N b W	S b W	N	4·96	...	...
2	·840	·800	·754	·795	49·5	55·9	49·0	51·7	+ 5·0	·308	·158	·270	·251	88	36	79	68	E N E	E b N	E b N	9·37	...	...
3	·768	·761	·751	·763	53·5	59·2	44·7	52·2	+ 5·1	·286	·217	·200	·219	71	44	69	58	E N E	E S E	E b N	7·57	...	...
4	·813	·758	·787	·784	48·1	60·5	47·4	52·1	+ 4·6	·237	·148	·166	·188	72	28	51	51	N b W	N	N b W	14·98	...	...
5	·836	·763	·710	·761	46.7	63·7	49·0	53·3	+ 5·6	·201	·271	·233	·221	64	47	74	57	N b W	S W	N N W	10·72	...	...
6	·609	·478	—	—	47·8	62·0	—	—	—	·189	·205	—	—	58	37	—	—	NWbW	N b W		10·63	...	...
7	·562	·526	·483	·524	38·2	42·1	34·1	38·1	—10·3	·116	·144	·166	·141	50	55	85	63	E N E	E S E	N b E	6·09	1·000	0·3
8	·353	·469	·568	·476	35·2	39·7	39·0	37·7	—11·1	·199	·202	·213	·202	97	83	91	90	N b N	NEbN	N N W	8·23	0 300	0·6
9	·700	·768	·818	·770	43·1	56·7	38·1	45·4	— 3·8	·152	·226	·167	·182	55	50	72	61	N b E	S	Calm.	5·69	...	...
10	·875	·825	·766	·816	46·3	59·2	42·4	50·1	+ 0·6	·258	·233	·171	·201	83	47	64	58	N	S S W	Calm.	3·88	...	...
11	·741	·630	·602	·651	45·0	64·9	42·4	52·0	+ 2·1	·184	·237	·182	·200	62	40	68	54	Calm	S b W	N b W	6·04	Inap.	...
12	·615	·572	·580	·588	51·0	66·6	48·6	54·3	+ 4·2	·266	·330	·276	·304	72	52	82	74	N b E	S b W	Calm.	1·66	Inap.	...
13	·582	·488	—	—	44·9	68·9	—	—	—	·256	·343	—	—	87	49	—	—	Calm	S b E		4·42	0·285	...
14	·632	·644	·563	·607	49·5	65·5	51·7	56·2	+ 5·3	·312	·367	·288	·330	89	60	76	75	S WbW	S b E	Calm	1·92	...	...
15	·487	·374	·283	·380	48·5	66·4	59·6	59·9	+ 8·6	·298	·441	·405	·396	89	70	82	79	Calm	S W b S	W b N	8·96	0·340	...
16	·398	·414	·596	·487	52·2	62·1	42·7	51·6	0·0	·354	·278	·214	·276	91	51	79	74	NWbW	NWbW	N N W	8·85	...	...
17	·736	·749	·755	·750	49·5	66 0	45·8	53·8	+ 1·8	·179	·261	·220	·215	50	42	72	54	N b W	N b W	Calm	4·63	...	...
18	·756	·666	·556	·618	46·4	62·7	51 6	55 0	+ 2·7	·219	·229	·207	·232	71	41	55	56	Calm	E N E	E	6·83	...	...
19	·504	·483	·486	·484	52·0	58·6	49·9	53·1	+ 0·5	·265	·349	·279	·303	70	72	79	76	Calm	E b S	Calm	1·32	...	...
20	·470	·458	—	—	57·4	74·3	—	—	—	·363	·449	—	—	79	55	—	—	N W	S W b S		7·27	...	...
21	·566	·541	·494	·526	51·7	59·6	46·6	53·3	0·0	·199	·223	·255	·231	54	44	81	60	N b E	S b W	Calm.	1·66	...	...
22	·513	·508	·497	·512	50·6	63·0	54·3	56·5	+ 2·8	·235	·237	·285	·251	65	42	69	57	Calm	S E b S	Calm.	0·89	...	...
23	·536	·506	·528	·528	54·1	61·0	54·3	56·2	+ 2·2	·245	·371	306	·295	60	70	74	66	E N E	E	Calm.	3·03	0·160	...
24	·566	·617	—	—	56·8	74·8	—	—	—	·310	·392	—	—	69	47	—	—	NWbW	S b W		4·84	...	...
25	·839	·772	·785	·801	51·7	65·3	47·8	54·9	+ 0·2	·288	·256	·198	·261	76	42	60	62	Calm	N b W	N b W	11·10	...	...
26	·888	·805	·835	·833	45·4	60·7	49·4	53·2	— 1·8	·158	·157	·241	·184	53	30	69	48	N	NWbN	N b W	11·31	...	...
27	·902	·823	—	—	50·6	63·0	—	—	—	·208	·237	—	—	57	42	—	—	N	S W b S		4·72	...	...
28	·797	·771	·737	·767	50·6	67·8	48·1	56·0	+ 0·3	·231	·286	·218	·261	63	43	66	60	N	S E b E	S E b E	1·82	...	...
29	·777	·758	·729	·755	51·7	71·4	49·5	57·9	+ 2·0	·245	·295	·266	·268	65	39	76	58	Calm	S E	Calm.	1·48	...	...
30	·792	·695	·633	·702	47·5	68·9	52·6	57·7	+ 1·5	·270	·415	·351	·344	84	60	90	74	N N E	E S E	Calm.	2·82	...	...
31	·627	·542	·447	·533	59·2	64·3	57·8	60·3	+ 3·7	·383	·425	·389	·400	77	72	83	78	S S E	S W b S	S b W	6·04	0·480	...
M	29·675	29·646	29·635	29·651	48·8	61·5	48·1	53·1	+ 1·6	·247	·277	·249	·258	·72	·51	·74	·65	4·09	7·96	4·00	5·93	2·55	0·9

Highest Barometer...... 29·902, at 6 a.m. on 27th } Monthly range:
Lowest Barometer....... 29·283, at 10 p.m. on 15th } 0·619 inches.
Highest registered temperature 77°·5, at p.m., 20th } Monthly range:
Lowest registered temperature 33°·0, at a.m. on 9th } 44°·5.
Mean Maximum Thermometer.............. 65°·40 } Mean daily range:
Mean Minimum Thermometer....... ...... 41°·42 } 23.98
Greatest daily range.........39°·4, from p.m. of 24th to a.m. of 25th.
Least daily range ....10°·0, from p.m. of 7th, to a.m. of 8th.
Warmest day....... 31st. Mean temperature......60°·25 } Difference,
Coldest day......... 8th. Mean temperature......37°·68 } 22°·57.
Greatest intensity of Solar Radiation, 89°·2 on p.m. of 20th } Range,
Lowest point of Terrestrial Radiation, 23°·6 on a. m. of 10th } 65°·6.
Aurora observed on 4 nights: viz. 1st, 8th, 10th, and 16th.
Possible to see Aurora on 20 nights. Impossible on 11 nights.
Raining on 6 days. Raining 30·9 hours; depth, 2·565 inches.
Snowing on 2 days. Snowing 7·0 hours; depth 0·9 inches.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North—2741·56 West—1017·04 South—690·05 East—998·66.
Mean direction of the Wind, N 1° W.
Mean velocity of the Wind, 5·93 miles per hour.
Maximum velocity, 24·7 miles per hour, from 10 to 11 a.m. on 4th.
Most windy day, the 4th; mean velocity, 14·98 miles per hour.
Least windy day, the 22nd; mean velocity, 0·89 " "
Most windy hour, noon; Mean velocity, 9·04 miles per hour.
Least windy hour, 1 a.m.; Mean velocity, 3·41 miles per hour.
Mean diurnal variation, 5·63 miles.
Mean of Cloudiness, 0·46.

1st. Total eclipse of the Moon from 8h 54m p.m. 1st, to 0.45m. a.m. of 2nd.

7th. Snow storm from 3h 30m p.m., continuing during the night.

8th. Snow storm until noon. Cold stormy day.

11th. Halo round the sun at 3 p.m.

15th. Severe thunder storm from 7 p.m. till midnight.

23rd. Thunder storm with heavy rain and large hailstones, from 0h 30m to 1h. 30m p.m.

The results of the above table show that the Mean Temperature of May, 1855, has been 1·°6 warmer than the average of the last 16 years. The total quantity of Rain, 0·4 inch. less than the average; and the velocity of the Wind 0·5 miles per hour greater than the average of the last 8 years.

Comparative Table for May.

YEAR.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch.	Wind Mean Velocity in Miles.	
1840	53·8	+2·3	74·5	30·8	43·7	9	4·150	...	...	...	
1841	50·5	—1·0	76·2	26·6	49·6	11	2·350	1	Inap.	0·35	lb.
1842	49·1	—2·4	74·3	30·0	44·3	7	1·275	...	...	0·53	lb.
1843	49·1	—2·4	79·6	28·9	50·7	5	1·570	...	...	0·52	lb.
1844	53·6	+2·1	77·7	29·0	48·7	14	5·670	...	...	0·30	lb.
1845	49·6	—1·9	76·6	29·4	47·2	8	2·300	...	...	0·55	lb.
1846	55·5	+4·0	78·1	34·3	43·8	9	4·375	...	...	0·46	lb.
1847	54·4	+2·9	72·5	27·8	44·7	12	2·040	...	...	0·29	lb.
1848	54·1	+2·6	78·5	31·9	46·6	13	2·520	...	...	4·93	Miles.
1849	48·0	—3·5	72·5	32·7	39·8	16	5·115	...	...	5·33	Miles.
1850	47·6	—3·9	76·3	31·1	45·2	7	0·545	1	Inap.	6·32	Miles.
1851	51·3	—0·2	73·2	28·7	44·5	12	2·950	1	0·5	6·34	Miles.
1852	51·4	—0·1	73·3	34·5	38·8	7	1·125	1	Inap.	4·00	Miles.
1853	50·9	—0·6	78·4	38·4	40·0	17	4·420	1	Inap.	5·14	Miles.
1854	52·2	+0·7	69·0	27·6	41·4	11	4·630	...	...	5·38	Miles.
1855	53·1	+1·6	74·8	33·9	40·9	6	2·565	2	0·9	5·93	Miles.
										0·43	lbs.
M'n.	51.51		75·34	30·97	44·37	10·3	2·975	0·4	0·1	5·42	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—May, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inches	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	29·851	29·987	30·051	49·0	70·6	52·6	·336	·541	·326	·93	·74	·81	N W b W	S W b S	N	5·80	1·00	2·50	0·170	Cir. Str. 8.	Cir. Str. 4.	Cl'rFt.Aur.Bor.
2	30·198	30·196	30·200	36·7	62·0	46·6	192	397	243	83	71	74	N E b E	E N E	E N E	0·37	6·40	3·76	...	Clear.	Clear.	Do.
3	30·180	30·105	30·001	38·1	58·3	45·0	173	327	253	72	66	80	N E	E b N	N W	3·20	4·26	0·37	...	Do.	Do.	Do.
4	29·952	29·990	29·999	41·4	56·9	52·1	217	323	304	79	70	76	N	N E b E	N E b N	8·37	10·96	9·32	...	Do.	Cir.Cum.Str. 10.	Str. 9.
5	·982	·976	·936	45·4	66.7	54·1	235	416	283	74	65	66	N b E	N b E	N N W	8·96	9·88	8·08	...	Do.	Do. 5.	Cir.Cum. Str. 6.
6	·720	·734	·785	47·4	52·8	36·0	252	264	176	74	66	76	N N W	N W	N W b N	2·87	10·00	11·55	...	Cir. Cum. 4.	Cum. 4.	Clear Auro. Bor.
7	·798	·845	·877	33·1	54·7	41·0	178	283	217	86	66	79	W N W	W	E	Inap.	0·39	Inap.	...	Clear.	Cir. Str. 8.	Do.
8	·840	·872	·862	40·8	58·0	47·7	217	327	234	80	66	69	N E b E	N E b E	N E b N	1·50	10·05	7·76	...	Light Cirr.	Clear	Do.
9	30·000	30·086	30·099	38·4	53·0	41·1	173	255	210	70	61	75	N E b N	N E b N	N E b N	20·39	16·94	6·20	...	Clear.	Do.	Do. ft.Aur. Bor.
10	30·090	30·050	30·001	32·0	66·0	52·0	167	373	264	83	58	66	N b E	N	N b W	2·50	3·15	1·55	...	Do.	Do.	Do.
11	29·985	29·900	29·894	53·7	73·0	46·6	293	465	274	70	58	70	W	S W	S E	0·94	0·81	0·40	...	Do.	Do.	Do.
12	·843	·911	·930	37·8	74·1	56·0	218	458	385	89	56	84	N E	W S W	W S W	1·03	2·54	2·69	...	Do.	Do.	Do.
13	·945	·895	·815	54·3	74·6	59·9	349	559	402	81	67	79	S b W	S b W	S W	3·75	2·22	3·07	Inap.	Do.	Hazy.	Cir. Cum. Str.
14	·846	·877	·942	53·2	63·7	52·1	386	435	304	93	75	76	W S W	W b N	N W	5·12	10·50	7·15	0·466	Cir. Str. 8.	Cir. 4.	Clear. [thunder
15	·890	·740	·671	48·4	55·7	49·9	302	372	349	86	84	94	E N E	N E b E	N E b N	0 30	8·97	Inap.	0·220	Rain.	Showers.	Nimb. 10.
16	·579	·642	·728	60·0	68·4	52·6	510	496	326	98	72	81	W b S	W N W	N W b W	4·75	5·25	9·12	0·900	Str. 10.	Cir. Cum. Str. 4.	Clear.
17	·835	·950	30·002	46·3	63·0	54·0	282	388	283	86	67	66	W b N	N W b N	N N W	2·74	7·25	7·37	...	Clear.	Clear.	Do.
18	30·100	30·149	9·900	39·5	71·7	58·3	214	506	389	84	67	79	W b S	S S W	S E b S	0·27	0·01	Inap.	...	Do.	Do.	Do.
19	29·934	29·890	·790	54·0	80·1	62·0	373	617	421	87	61	74	N E b E	S S E	S S E	Calm	0·02	0·42	...	Do.	Hazy.	Str. 2.
20	·701	·680	·831	58·0	81·0	50·6	412	617	326	84	60	88	W S W	S S E	N E	Inap.	Calm	11·62	Inap.	Do.	Cum. Str. 4.	Clear.
21	·820	·815	·841	39 0	62·2	47·7	196	375	271	76	67	80	N b W	N E b E	N E b E	13·38	7·53	10·00	...	Do.	Do. 2.	Do.
22	·851	·900	·941	47·6	60·0	44·1	291	393	282	86	75	92	N E b E	E	N E b E	1·55	3·78	2·37	...	Do.	Do. 6.	Do. [a.m. 36°·0.
23	·982	·979	·985	45·9	66.1	52·0	272	440	326	86	68	81	N E b N	S E	N E b E	4·25	2·51	2·25	...	Cir. Str. 8.	Clear.	Cir. 4,lunar halo
24	·820	·801	·900	50·6	76·1	55·0	349	692	372	93	87	84	E N E	W S W	N W	0·11	3·85	10·00	...	Do. 4.	Do.	Clear Auro. Bor.
25	·985	·952	30·048	48·0	58·2	43·0	281	274	199	80	55	70	W N W	N N W	N W	12·30	11·68	12·37	...	Clear.	Cir. Str. 8.	Cir. 2.
26	·999	·938	30·001	43·5	55·0	48·9	272	372	261	90	84	74	N W	N W	N N W	9·93	10·63	11·11	...	Do.	Do.	Cum. Str. 8.
27	·998	·943	29·980	46·1	71·1	55·8	253	320	262	92	42	59	W b N	N b W	N	2·61	12·80	10·43	...	Do.	Clear.	Clear.
28	30·060	30·020	30·050	50·6	78·0	58·7	246	428	327	65	45	66	N b W	S b W	S E	3·62	1·90	0·37	...	Do.	Do.	Do.
29	30·095	30·105	30·046	54·4	80.4	56·7	326	506	343	76	50	74	N E b E	S b E	S S W	3·37	Inap.	Calm	...	Do.	Do.	Hazy.
30	30·009	30·000	30·002	57·2	84·5	63·0	376	550	435	79	48	75	S b W	S W b W	S S W	Inap.	1·80	Calm	...	Hazy.	Hazy.	Do.
31	30·030	29·913	29·870	62·0	89·0	72·8	421	588	523	75	44	67	S S E	S W b S	W S W	Inap.	2·03	3·00	...	Do.	Do.	Do.

Barometer	Highest, the 2d day	30·200
	Lowest, the 16th day	29·579
	Monthly Mean	29·637
	" Range	0·621
Thermometer	Highest, the 31st day	91°·8
	Lowest, the 7th day	28°·9
	Monthly Mean	56°·85
	" Range	62°·9
	Mean Humidity	·743

Greatest Intensity of the Sun's Rays .... 99°·4

Rain fell on 6 days, amounting to 1·756 inches, raining 15 hours 10 minutes, and was accompanied with thunder on two days.

Most prevalent Wind, N E b E. Least prevalent Wind, E.

Most Windy Day, the 25th day; mean miles per hour, 12·11.

Least Windy Day, the 7th day; mean miles per hour, 0.13.

Aurora Borealis visible on 3 nights. Might have been seen on 18 nights.

The electrical state of the atmosphere has been marked by moderate intensity; and during the storms of the 14th and 15th days indicated a very high tension of a negative character.

Eclipse of the moon on the 1st day visible.

Ozone.—The amount of Ozone was very small in quantity during the month.

Shad first caught here on the 31st day.

Monthly Meteorological Register, Quebec, Canada East, May, 1855.

BY LIEUT. A. NOBLE, R. A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Elasticity of Air.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.
	6 A.M.	2 P. M.	10 P. M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		
					°	°	°	°																
1	29·617	29·705	29·806	29·709	39·6	51·1	40·5	43·7	0·232	0·272	0·240	0·248	97	74	97	81	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...
2	·952	·960	·995	·969	35·3	41·8	35·4	37·5	·145	·122	·146	·138	70	47	71	63	W	E N E	Calm.	8·8	8·0	0·0	...	...
3	30·005	·860	·767	·877	33·7	47·1	38·1	39·6	·142	·149	·152	·148	74	46	67	62	Calm.	E	N N W	0·0	9·3	5·2	...	...
4	29·727	·725	·741	·731	36·5	42·0	41·9	40·1	·190	·235	·248	·224	88	89	94	90	E N E	E N E	E N E	2·0	10·9	5·2	·058	...
5	·712	·674	·595	·660	42·6	51·0	51·8	48·5	·255	·252	·132	·216	94	69	35	66	Calm.	E N E	N W b N	0·0	7·2	12·4	...	...
6	·420	·398	·448	·422	44·6	46·3	36·3	42·4	·193	·182	·189	·188	67	59	88	71	W	E N E	Calm.	2·0	13·4	0·0	...	...
7	·497	·582	·671	·583	35·9	46·0	39·0	40·3	·169	·168	·188	·175	81	57	80	73	Calm.	E	E N E	0·0	7·2	11·3	...	...
8	·671	·652	·750	·691	36·5	46·1	41·5	41·4	·187	·116	·094	·132	87	38	36	54	N E	E	E	2·0	17·9	16·0	...	...
9	·876	·884	·895	·885	36·0	43·1	39·2	39·4	·123	·105	·134	·121	59	39	56	51	E N E	E	N	13·7	27·8	7·2	...	...
10	·838	·779	·756	·808	35·0	51·1	42·4	42·8	·136	·082	·137	·118	68	22	51	47	Calm.	E b N	N	6·0	15·2	2·0	...	...
11	·744	·687	·693	·708	37·1	48·8	41·9	42·6	·152	·108	·198	·153	69	32	75	59	Calm.	E	N N E	0·0	13·4	8·0	...	...
12	·691	·619	·707	·672	39·1	60·8	43·1	47·7	·205	·156	·204	·188	87	30	74	64	N E	S E	E N E	5·2	5·2	12·4	...	...
13	·778	·646	·583	·669	40·8	57·7	46·0	48·2	·205	·262	·250	·239	81	56	83	73	E N E	E	E	8·8	3·8	8·0	·438	...
14	·563	·533	·662	·586	46·6	60·7	47·3	51·5	·305	·220	·179	·241	100	42	56	66	Calm.	N W	W b N	0·0	10·0	12·4	·066	...
15	·705	·592	·517	·605	41·4	50·0	47·8	46·4	·191	·283	·300	·258	74	80	91	82	Calm.	Calm.	E	0·0	0·0	3·8	1·142	...
16	·345	·334	·405	·361	46·3	62·3	48·7	52·4	·309	·435	·307	·350	100	78	91	90	Calm.	N W	E b N	0·0	10·0	8·8	·409	...
17	·491	·625	·767	·628	47·8	56·0	53·4	52·4	·205	·179	·153	·179	62	41	78	60	W S W	N W	N W	15·2	18·3	10·0	...	...
18	·884	·800	·745	·810	45·2	65·2	55·8	55·4	177	·213	·222	·204	60	35	51	49	Calm.	S S W	Calm.	1·0	13·4	0·0	...	...
19	·728	·580	·499	·602	46·8	73·0	60·8	60·2	·220	·254	·273	·249	70	32	52	51	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...
20	·521	·469	·595	·528	43·8	44·2	38·5	42·2	·199		·167		.0		72		E b N	E b N	E	34·1	35·9	27·8	...	...
21	·559	·573	·608	·579	38·2	44·0	42·8	41·7	·142	·180	·211	·178	62	63	77	67	E	E	E b S	12·4	16·9	21·3	...	...
22	·626	·703	·741	·690	42·3	45·0	41·6	43·0	·186	·202	·222	·203	70	69	85	73	E	E N E	E	22·7	27·8	30·1	...	...
23	·749	·736	·733	·739	41·3	52·1	44·4	45·9	·247	·259	·263	·256	97	67	91	85	E N E	E N E	E N E	16·0	10·0	10·0	...	...
24	·683	·518	·654	·618	42·3	56·1	51·6	50·0	·266	·297	·217	·260	100	67	58	76	E N E	E N E	Calm.	8·0	2·0	0·0	...	...
25	·676	·686	·734	·699	46·0	49·2	42·6	45·9	·209	·182	·165	·185	69	52	61	61	Calm.	N W	N W	0·0	13·9	15·2	Inap.	Inap
26	·654	·676	·740	·669	42·3	49·4	45·9	45·9	·181	·165	·179	·175	68	47	58	58	W S W	N W	N W	10·0	11·3	8·0	...	...
27	·700	·666	·717	·694	42·7	57·4	55·3	51·8	·135	·157	·191	·161	50	34	44	43	N W	N	N N W	10·0	11·3	3·8	...	...
28	·828	·839	·900	·856	46·4	55·8	49·0	50·4	·204	·184	·257	·215	65	42	75	61	N N W	E	E N E	2·0	11·3	11·3	...	...
29	·954	·875	·849	·893	45·0	70·1	56·5	57·2	·226	·231	·254	·137	76	32	57	55	E N E	S	Calm.	16·0	16·5	0·0	...	...
30	·930	·816	·805	·850	50·1	68·5	50·9	56·5	·276	·351	·312	·318	78	52	85	72	E N E	Calm.	W	7·2	0·0	6·2	...	...
31	·827	·674	·599	·780	52·0	81·1	70·7	67·9	·296	·374	·387	·352	78	76	53	69	W	W	S S W	2·0	12·4	2·0	...	...
M	29·733	29·695	29·726	29·7180	43·31	55·77	48·02	49·03	0·204	0·213	0·213	0·210	73	52	72	66				6·84	12·00	8·68	2·113	

REMARKS.

1st. Tho chief characteristics of the Lunar Eclipse were the violet hue about tho boundary between the unbra and penumbra, and the glowing red color of the moon when totally eclipsed. A brilliant Aurora observed.

1st. The wind at 2 p.m., in gusts, occasionally with a velocity of 35 miles per hour.

22d. At 6 p.m. velocity of wind 54 miles per hour.

The 20th day is not included in making up the hourly and monthly means of elasticity and humidity.

Maximum Barometer, 6 a.m. on the 3d	30·005
Minimum Barometer, 2 p.m. on the 16th	·334
Monthly Range	·671
Monthly Mean	29·7180
Maximum Thermometer on the 31st	83°·0
Minimum Thermometer on the 2d	32·0
Monthly Range	51·0
Mean Maximum Thermometer	56·16
Mean Minimum Thermometer	39·94
Mean Daily Range	16·22
Mean Monthly Temperature	49·03

Greatest Daily Range of Thermometer on 19th	29°·7
Least Daily Range of Thermomter on 21st	6°·9
Warmest Day, 31st. Mean Temperaturo	67·9
Coldest Day, 2nd. Mean Temperature	37·5
Climatic Difference	30·4

Possible to see Aurora on 18 Nights.
Aurora observed on 14 Nights.
Total quantity of Rain, 2·113 inches.
Total quantity of Snow, inap.
Rain fell on 6 days.
Snow fell on 1 day.

The Canadian Journal.

TORONTO, AUGUST, 1855.

On an Earth-Boring Machine.

BY COLIN MATHER.*

The construction of Mr. Mather's new boring-head and shell-pump, and the mode of acquiring the percussive motion, constitute the chief novelties of the system and machine. The couple-cylinder engine, with the reversing or link motion, is used for winding and lowering apparatus; but an ordinary winding engine, similar to those used in collieries, may be applied.

The boring-head consists of a wrought-iron bar, about eight feet long, on the lower part of which is fitted a block of cast-iron, in which the chisels or cutters are firmly secured. Above the chisels an iron casting is fixed to the bar, by which the boring-head is kept steady and perpendicular in the hole. A mechanical arrangement is provided, by which the boring-head is compelled to move round a part of a revolution at each stroke. The loop or link by which the boring apparatus is attached to the rope is secured to a loose casting on the wrought-iron bar, with liberty to move up and down about six inches. A part of this casting is of square section, but twisted about one-fourth of the circumference. This twisted part moves through a socket of corresponding form on the upper part of a box, in which is placed a series of ratchets and catches, by which the rotary motion is produced. Two objects are here accomplished—one the rotary motion given to the boring-head, the other a facility for the rope to descend after the boring-head has struck, and so prevent any slack taking place, which would cause the rope to dangle against the side of the hole, and become seriously injured by chafing.

The shell-pump is a cylinder of cast-iron, to the top of which is attached a wrought-iron guide. The cylinder is fitted with a bucket similar to that of a common lifting-pump, with an India-rubber valve. At the bottom of the cylinder is a clack, which also acts on the same principle as that in a common lifting-pump, but it is slightly modified to suit the particular purpose to which it is here applied. The bottom clack is not fastened to the cylinder, but works in a frame attached to a rod which passes through the bucket, and through a wrought-iron guide at the top of the cylinder, and is kept in its place by a cotter, which passes through a proper slot at the top of the rod. The pump-rod, or that by which the bucket is worked, is made of a forked form, for the two-fold purpose of allowing the rod to which the bottom clack is attached to pass through the bucket, and also to serve as the link or loop by which the whole is suspended.

The wrought-iron guide is secured to the top of the cylinder, and prevents the bucket from being drawn out when the whole is so suspended. The bottom clack also is so arranged that it is at liberty to rise about six inches from its seating, so as to allow large fragments of rock, or other material, to have free access to the interior of the cylinder when a partial vacuum is formed there by the up-stroke of the pump.

The percussive motion is produced by means of a steam-cylinder, which is fitted with a piston of 15 inches diameter, having a rod of cast-iron 7 inches square, branching off to a fork in which is a pulley of about three feet in diameter, of sufficient breadth for the rope to pass over, and with flanges to keep it in its place. As the boring-head and piston will both fall by their own weight when the steam is shut off, and the exhaust-valve opened, the steam is admitted only at the bottom of the cylinder; the exhaust-port is a few inches higher than the steam-port, so that there is always an elastic cushion of steam of that thickness for the piston to fall upon.

The valves are opened and shut by a self-acting motion derived from the action of the piston itself; and as it is of course necessary that motion should be given to it before such a result can ensue, a small jet of steam is allowed to be constantly blowing into the bottom of the cylinder; this causes the piston to move slowly at first, so as to take up the rope, and allow it to receive the weight of the boring-rod by degrees, and without a jerk. An arm which is attached to the piston-rod then comes in contact with a cam, which opens the steam-valve, and the piston moves quickly to the top of the stroke. Another cam, worked by the same arm, then shuts off the steam, and the exhaust-valve is opened by a corresponding arrangement on the other side of the piston rod. By moving the cams, the length of the stroke can be varied at the will of the operator, according to the material to be bored through. The fall of the boring-head and piston can also be regulated by a weighted valve on the exhaust-pipe, so as to descend slowly or quickly, as may be required.

The general arrangement of the new machine may be described as follows :—

The winding drum is 10 feet in diameter, and is capable of holding 3,000 feet of rope, 4½ inches broad and half an inch thick; from the drum the rope passes under a guide-pulley, through a clam and over the pulley which is supported on the fork end of the piston-rod, and so to the end which receives the boring-head, which being hooked on and lowered to the bottom, the rope is gripped by the clam. A small jet of steam is then turned on, causing the piston to rise slowly until the arm moves the cam, and gives the full charge of steam; an accelerated motion is then given to the piston, raising the boring-head the required height, when the steam is shut off, and the exhaust opened in the way described, thus effecting one stroke of the boring-head as regulated by a back-pressure valve in the exhaust-pipe. The exhaust-port is six inches from the bottom of the cylinder; when the piston descends to this point, it rests on a cushion of steam, which prevents any concussion. To increase the lift of the boring-head or compensate for the elasticity of the rope, which is found to be one inch in one hundred feet, it is simply necessary to raise the cams on the cam-shaft whilst the percussive motion is in operation. The clam which grips the rope is fixed to a slide and screw, by which means the rope can be given out as required. When this operation is completed, and the strata cut up by a succession of strokes thus effected, the steam is shut off from the percussive cylinder, the rope unclamped, the winding-engine put in motion, and the boring-head brought up and slung from an overhead suspension bar by a hook fitted with a roller to traverse the bar. The shell-pump is then lowered, the *débris* pumped into it, by lowering and raising the bucket about three times, which the reversing motion of the winding-engine readily admits of; it is then brought to the surface and emptied by the following very simple arrangement. At a point in the suspension-bar a hook is fixed perpendicularly over a small table in the waste-tank, which table is raised and lowered by a screw. The pump being suspended from the hook hangs directly over the table, which is then raised by the screw till

* Journal of the Society of Arts.

it receives the weight of the pump. A cotter, which keeps the clack in its place, is then knocked out, and the table screwed down. The bottom clack and the frame descending with it, the contents of the pump are washed out by the rush of water contained in the pump-cylinder. The table is again raised by the screw, and the clack resumes its proper position; the cotter is then driven into the slot, and the pump is again ready to be lowered into the hole as before. It is generally necessary for the pump to descend three times in order to remove all the *débris* broken up by the boring-head at one operation.

The following facts obtained from the use of the machine in boring in the new red sandstone at Manchester will show its actual performance, and enable us to compare it with the other systems mentioned in this paper. The boring-head is lowered at the rate of 500 feet a minute; the percussive motion is performed at the rate of 24 blows a minute, and being continued for 10 minutes, the cutters in that time penetrate from 5 to 6 inches; it is then wound up at 300 feet a minute. The shell-pump is then lowered at the rate of 500 feet a minute, the pumping continued for one minute and a half, and being charged, the pump is wound up at 300 feet a minute. It is then emptied, and the operation repeated, which can be accomplished three times in 10 minutes, at a depth of 200 feet. The whole of one operation, resulting in the deepening of the hole 5 to 6 inches, and cleaning it of *débris* ready for the cutters or boring-head being again introduced, is seen to occupy an interval of 20 minutes only. The value of these facts will be best shown by comparing them with the results by the old method.

At Highgate the boring has occupied two years in attaining a depth of 680 feet from the bottom of a well 500 feet deep from the surface. Their progress at present is at the rate of 6 inches per week, working night and day. At Warwick, 13 months were occupied in boring 400 feet through red marl; at Saltaire, two years in going 80 yards.

One well-known defect of the old method of boring consists in the "buckling" and dangling of the rods, which has the effect of enlarging the hole in some instance to a diameter of four feet where soft strata intervene. This arises from the buckling and dangling of the rods causing them to strike against the sides of the hole, and breaking off portions of earth which fall to the bottom, thus considerably increasing the quantity of *débris* to be brought up by the shell, and occupying an immense time in getting out the *débris* which has merely fallen from the side, without increasing the depth of the hole. This is a serious defect where geological purposes are to be served by the boring, because the earth from the side falling to the bottom of the hole mixes with that which is cut up by the chisel, and thus prevents an accurate knowledge being obtained of the strata which the boring has penetrated. It must be remarked also that the defect of buckling is to crystallise the iron, deteriorating its quality, and thereby causing those frequent breakages which retard progress, and add so materially to the expense of this system of boring. The process of crystallisation being beyond the observation of the workmen, the result is scarcely, if ever, known till the breaking of the rods reveals it. To remedy this difficulty, and obviate the effects of buckling, it has been found necessary to put down iron tubes into the bore-hole. As the first length of these tubes can scarcely be got to a depth of more than 200 feet, on account of the great external friction, it is necessary, when the tube has to be carried to a further depth, to put down a second and a third length of tube; and as each length must come to the surface, the diameter of the bore-hole is very materially diminished. It will easily be seen that when the bore-hole is required to be of considerable depth, this diminution of its diameter will at length so contract the hole as to render the supply of water comparatively limited, and, in fact, to threaten the design with actual failure, after a vast outlay has been incurred. These inconveniences, so serious in character, are all obviated by the new method of boring. No rods are used; and as the rope which is substituted for them seldom comes in contact with the sides of the hole so as to disturb the strata, tubing will rarely be required. Indeed, it will only be necessary when the particular strata through which the hole passes happens to be very fluid; and even then it will not always be wanted. The great power of pumping and the facility of winding possessed by this new machine would enable it to exhaust any ordinary quicksand which might find its way into the hole. The pumping process could be carried on at a depth of 500 feet, at the rate of a cart-load per hour. It is possible with the improved machine to cleanse the hole so effectually that not a loose particle remains at the bottom. This will at once be seen from the fact that the pump has sufficient power to draw in masses of rock or other substances of from three to four pounds weight. This circumstance renders the machine particularly useful in geological researches, inasmuch as the lowest strata are brought up in a state of the greatest possible compactness and purity, notwithstanding any admixture of earth from the sides, or of that which the shell has been unable to bring up in the previous operation.

Notice of the Application of the Thistle to the Manufacture of Paper.

PATENTED BY LORD BERRIEDALE, LONDON, JULY 8, 1854.*

Whilst India and other tropical regions have been traversed in search of a plant to be used in place of rags in the paper manufacture, Lord Berriedale has turned his attention nearer home, and has selected the common thistle as the most suitable plant for his purpose. His invention relates to the application and use of the common thistle, or *Carduus*, as it is termed, according to the botanical classification of Linnæus, in the manufacture or production of pulpy material from which paper is to be made, as well as in the manufacture of a fibrous material for textile purposes. All the varieties of the thistle plant are applicable for the purposes of this invention, but more particularly the large Scottish thistle, which grows luxuriantly in many parts of the British Islands, attaining a great height and thickness of stem. Such thistles furnish, in each plant, a large amount of long fibre of great tenacity, and which, when duly prepared, is most excellently suited for the preparation of a powerfully cohering paper pulp, as well as for use in textile manufactures.

In adapting the thistle to the manufacture of paper pulp, the plant is used either in a green or dried state. If employed in its natural green condition, it is cut or gathered, and at once beaten or broken up by any suitable mechanism, such as is used in the primary treatment of the flax plant, so as to disintegrate the fibrous or ligneous matter. During this breaking treatment, the mucilaginous and aqueous matter present is washed clear away, either by pure water, or by an acidulous solution, or by any other economical and effective cleansing agent. When the thistle stems are thus fully reduced or distintegrated,

* From the Lond. Pract. Mechanics' Journ., March, 1855.

the resultant fibrous mass is worked up or macerated in the usual manner, for the production of a pulp suitable for the use of the paper-maker. This pulp may be used in the manufacture of paper, either unmixed, or commingled with other materials already in use for making paper. The routine of manufacture into paper of the pulp, is similar to that pursued with the ordinary rag pulp, or it may be varied, as the properties of the thistle may suggest. The thistle fibre being strong, the paper made from it is of great tenacity, the fibres cohering well together in the paper machine, and being worked up with very little loss from washing away. The fibres are also of good colour; hence paper of a fair colour may be made from them without bleaching, and if bleaching is resorted to, a very good white colour is obtained at a slight expense. The mucilaginous or gummy matter dislodged from the fibres may be collected and applied in the manufacture of gum or glutinous matter, or it may be otherwise rendered commercially valuable, so as still further to economize the thistle manufacture. In applying the thistle plant to the manufacture of textile materials, the fibres are primarily prepared in the manner already described, and then subsequently treated according to the existing textile processes—such, for instance, as are adopted in the flax manufacture, the thistle fibre being closely allied to the fibre from the flax plant, as regards its general characteristics. Being strong and of good staple, the thistle fibre is particularly well suited for the spinning and weaving processes.

Further Observations on associated cases, in Electric Induction, of Current and Static Effects.

BY PROF. FARADAY, D.C.L., F.R.S., &c.*

Melloni, whose loss science must deeply feel, was engaged in the latter part of his life in investigations relating to static electricity, especially concerning induction, conduction, &c. He desired, in reference to these and the results I had published respecting the charge of, and conduction by, subterraneous and subaqueous insulated wires, to know whether there was any difference in the *time* of transmission through such wires, of currents having greater or less intensity, *i. e.* of currents from batteries of different numbers of plates. I applied to Mr. Latimer Clark on the subject; and he with the same earnestness as on the former occasion, sought and seized the opportunity of making experiments of the like kind, and gave me the results, which I sent to Melloni. The latter published them with some observations in an Italian Journal (whose title is not on the paper which he sent to me), and soon after he was suddenly removed from us by death. As Mr. Clark's results are not yet known in this country, I have thought that a brief account of them would be valuable. His process records, by the printing telegraph of Bain, the results obtained with 768 miles of copper wire covered with gutta percha, and laid in the ground in four lines between London and Manchester, so connected that the beginning and the end of the whole length was in London. The following are his words, dated May 31, 1854:—

"I have tried a few experiments on the relative velocities of currents of different intensities, and I enclose you some strips of paper showing the results. I was unable to equalize the deflexions of a galvanometer by currents of intensity with small plates as compared with currents from a few large plates, for no size of plate would make up for the deficiency in intensity. I allude to the form of experiment suggested by Melloni;—but I believe they will be of interest to him.

"The experiments were made through 768 miles of gutta percha wire, viz.: from London to Manchester and back again twice, with our ordinary sulphate of copper batteries, plates 3 inches square, and with intensities varying from 31 cells to sixteen times 31 cells, or 500 cells.

"In the accompanying strips the upper line indicates the time during which the current was sent, being made by a local arrangement.

"The second line (of dots) indicates *time by seconds*, being made by a pendulum vibrating seconds, and striking a light spring at the centre of its arc of vibration.

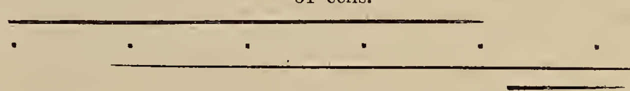
"The third line indicates the time at which the current appeared at (what we call) the distant end of the line, 768 miles off.

"The fourth line merely shows the residual discharge from the near end of the wire, which was allowed to communicate with the earth as soon as the batteries were disconnected; this has no reference to the subject of our enquiries.

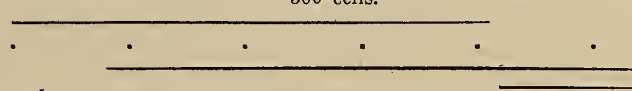
"It will be seen by the *third line*, that about two-thirds of a second elapsed in every case before the current became apparent at the distance of 768 miles, indicating a velocity of about 1000 miles a second; but the most interesting part appears to be, that this velocity is *sensibly uniform for all intensities* from 31 cells to 500."

Melloni has then given a copy of the records made when 31 pair and 500 pair of plates were employed; unfortunately the copy is inaccurate, since it makes the fourth line commence as to time at the termination of the third, whereas it ought to correspond with the termination of the first; also the third line on each does not thin off as those upon the record do. The following is a copy from other slips obtained at the same time from the Bain's printing apparatus. Experiments with 62, 125, and 250 cells, gave like results with those of 31 and 500 cells.

31 cells.



500 cells.



After certain observations, which are mainly upon the manner of the experiments, and the way in which practical difficulties were avoided, Melloni says, "it appears, then, that when the electric current possesses sufficient force to overcome the sum of the resistance offered by a given conductor, whatever its length may be, an augmentation of its intensity ten or twenty fold does not alter the velocity of its propagation. This fact is in open contradiction with the general meaning attributed to the denominations of *quantity* and *intensity*; since the first compares the mass of electricity to that of a fluid, and the second represents its elasticity or tendency to motion. The equal velocity of currents of various tension offers, on the contrary, a fine argument in favour of the opinion of those who suppose the electric current to be analogous to the vibrations of air under the action of sonorous bodies. As sounds, higher or lower in pitch, traverse in air the same space in the same time, whatever be the length or the intensity of

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* From the Lond., Edin. and Dub. Philos. Mag. March, 1855.

the aërial wave formed by the vibration of the sonorous body; so the vibrations, more or less rapid or more or less vigorous, of the electric fluid excited by the action of batteries of a greater or smaller number of plates, are propagated in conductors with the same velocity. Every one will see how the hypothesis imagined by us to give a reason for natural phenomena, will serve to suggest certain experimental investigations, the results of which will test their validity or insufficiency."

Melloni then says, that he shall shortly have occasion to publish facts which clearly demonstrate the errors of certain conclusions admitted up to the present time respecting electrostatic induction; and I am aware, from written communications with him, that he considered the results arrived at by Coulomb, Poisson, and others since their time, as not accordant with the truth of nature.* In the meantime he died, and whether his researches are sufficiently perfected for publication or not, I do not know.

The uniformity in the time and appearance of currents of different intensities at the further end of the same wire in the same inductive state, is a very beautiful result. It might at first be supposed to be in opposition to the views I set forth some years ago on induction and conduction, and the statements more recently made with regard to *time*. That, however, does not appear to me to be the case, as a few further observations on Mr. Clark's recent experiments will perhaps show. When the smaller battery is used, much less electricity passes into the wire in a given time, than when the larger one is employed. Suppose that the batteries are so different that the quantities are as 1 to 10; then, though a pulse from each would take the same time for transmission through the wire, still it is evident that the wire would be a tenfold better conductor for the weak current than for the strong one; or in other words, that a wire having only one-tenth of the mass of that used for the greater current should be employed for the smaller one, if the resistance for *equal quantities* of electricity having different intensities is to be rendered equal.

My views connect the retardation of the transmitted current with the momentary induction set up laterally by the insulated and externally coated wire. The induction will be proportionate to the intensity, and therefore its especial effect on the time of retardation proportionately diminished with the less intense current,—a result of action which will aid in rendering the time of retardation of the two currents equal.

The difference of *time* in the former experiments with air wires, and earth or water wires, very clearly depends upon the difference of lateral induction; the air wire presented a retardation scarcely sensible, the earth wire one amounting to nearly two seconds. If the insulating layer of gutta percha could be reduced from 0·1 to 0·01 of an inch in thickness, and mercury could be placed on the outside of that instead of water or earth, I do not doubt that the time would be still more increased. Yet there is every probability that in any one of these varying cases, electric currents of high and of low intensity would appear at the end of the same long wire after equal intervals of time.

Mr Clark's results may be stated thus:—A given quantity of electricity at a high intensity, or a smaller quantity at a proportionally lower intensity, will appear at the further end of the same wire after the lapse of the same period of time. My statement assumed the discharge of the *same* quantity at *different* intensities through the *same wire*, and the quantities in the illustrative experiments were measured by a Leyden jar. In the consideration and further development of these results, it must be remembered that it is not the difference either in time, velocity, or transmission of a *continuous* current which constitutes the object in view; for that is the same both for an air wire and a subterraneous wire, but it is the difference in the *first appearance* only of the same current when wires under these different conditions are employed. After the first appearance both wires are alike in power unto the end of the current, and then a difference again appears which is complementary to the first.

There are many variations of these experiments which one would wish to make, if possible, and perhaps by degrees the possibility, or else equivalent experiments in other forms, may occur. If the wire employed were changed from a cylinder to a flat ribbon of equal weight, or to several small wires, all being equally coated with gutta percha and submerged, differences would probably arise in the time of delay with the same current; and I think that the ribbon, presenting more induction surface than the cylinder, would cause more delay; but probably any of these, or of like varieties, would cause the *same* delay for currents of different intensities. Again, one can scarcely doubt that with different conducting substances, as iron and copper, the delay would vary, as is the case in the transmission of sound and light. That the delay for currents of high and low intensity should be the same for the same wire in any one of such cases may still be expected, but it would be very interesting to *know* what would be the fact.

The prosecution of these results and the principles concerned in them, through the various forms they may assume by such like variations of the conductors and also of the currents, offers, as Melloni has observed, most extensive and interesting inquiries; even the power of a current to induce a current in neighboring wires and conductors is involved in the inquiry, and also the phenomena and principles of magneto-electric induction.

* He says, "I deceive myself much, or else the fundamental theorem of electrical induction, as we find it ordinarily announced, ought to be modified so as not to confound two effects completely distinct—the electric state during induction, and after the contact and separation of the inducing body. We know perfectly what occurs in the latter case, but not in the former," &c. Again, "In my last letter I raised doubts with regard to the consequences which have up to the present been deduced from the experiments serving as a base for the fundamental theorem of electro-static induction. These doubts have passed to a state of certitude in my mind, ... and behold me at this time thoroughly convinced that the enunciation of that theorem ought to be essentially modified." (July, 1854.)

On taking Daguerreotypes without a Camera.

BY J. F. MASCHER.*

The accompanying stereoscopic pictures were taken by me, by means of a box (to be described hereafter) that contained neither lenses, reflectors, or in short any refracting or reflecting medium of any kind. I accidentally made the discovery that photographic pictures could be taken in this manner while prosecuting some experiments relative to stereoscopic angles.

It is well known that two pictures taken with two ordinary cameras placed only 2½ inches apart horizontally, will not when placed in the stereoscope show proper or sufficient stereoscopic relief, yet it is well known that the human eyes are only placed 2½ inches apart, yet are enabled to see solid objects in their proper solidity and relief; and to explain the why and wherefore of these facts has challenged the attention of Professor Wheat-

* Journal of the Franklin Institute.

stone, Sir David Brewster;* and a host of others. Under these circumstances we may be permitted to ask, why is it that two pictures, taken by two cameras placed 2½ inches apart, do *not* show sufficient stereoscopic relief? Why is it that we must place the cameras about eight times farther apart than the human eyes are in order to produce the proper relief? When these questions first suggested themselves to me, the following answer occurred to me without at that time being able to prove it to be the correct one; namely, because the lenses in the cameras (¼ size) are twelve times larger than the human lenses (eyes).

In order to ascertain whether this is the correct answer or not, it was only necessary to take two pictures with two cameras having a diaphragm in each, the openings in which are ⅛ of an inch in diameter, that being the diameter of the diaphragm in the human eye. In executing this experiment, I was very much surprised to find that the focal range of the camera was increased to an extraordinary extent. The cameras had been focussed for a house on the opposite side of the street, but the moment the diaphragm was introduced, the sash in the window, which before was invisible, suddenly became as sharp and distinct as the house on which the focus had been previously drawn. Subsequently, on removing the camera to an upper story of my house, it was found that this increase in focal range extended not only from the house towards the camera, but to an equal extent beyond the house. After ascertaining these facts, it became desirable to find out the cause of them. With this end in view, the lenses were removed from the tube, and only the diaphragm remained in the same. You may well imagine my astonishment at finding the pictures of houses and other objects in the street faithfully depicted upon the ground glass! the letters of signs, &c., reversed, precisely as if the lenses had been used. The next step was to ascertain whether these pictures possessed photogenic properties, which was soon done by substituting a metal diaphragm with an aperture of 1-50 of an inch in diameter for the paper one of ⅛ inch in diameter, putting in a coated plate, leaving it remain fifteen minutes, coating it in the usual manner, and a beautiful picture, similar to the one herewith sent, was the result.

It was self-evident now, that we had the means to do that with one camera, for which two were before deemed indispensable, namely, taking two stereoscopic pictures through two apertures situated only 2½ inches apart. But as a quarter size plate is only 4¼ inches long, and as it was desirable to take the two pictures on one plate, two apertures 1-66 of an inch in diameter were made in the metal plate above alluded to, only 2½ inches apart, and after twenty minutes exposure, the sun shining on the house all the time, the accompanying pictures were the result, thus demonstrating conclusively that two stereoscopic pictures can be taken on one plate with one camera (or dark chamber without lenses) and simultaneously, without either reflectors or refractors of any kind whatsoever! It may here be remarked, however, that the pictures thus taken on one plate are stereoscopic reverse, that is to say, the right picture is on the side where the left one ought to be, and *vice versa*, which can, however, be very readily remedied by cutting the plate in two and pasting them together again properly. This stereoscopic reverse was next attempted to be remedied by placing a reflector before the apparatus, but the only effect produced by this device, was the same as the same reflector produces upon pictures taken by an ordinary camera, namely, making the pictures appear in their natural position, so that letters on signs, &c., could be read correctly.

There is another advantage resulting from this camera; it is this. You may make two, four, six, or more sets of holes in the same camera, either all of the same diameter, by which means you will obtain an equal number of stereoscopic pictures with the number of sets of holes, or you may make one set with apertures of 1-200 of an inch, another 1-100 of an inch, one set 1-70 of an inch, and still another set with 1-25 of an inch in diameter, where you will be certain to obtain at least one set of pictures properly "timed," especially as the other pictures which are not properly timed can be rubbed out before gilding, thus saving the plates.

* Mr. Mascher disclaims, in the July number of the Journal of the Franklin Institute, the merit of having first originated the explanations relating to the distortions of pictures. He refers to an article by Sir David Brewster on that subject, published in vol. xv. *Silliman's Journal*, p. 291.

On the Composition of Eggs in the Animal Series.

The conclusions to which M. M. Valenciennes and Frèmy have arrived with respect to the composition of Eggs in the Animal Series are as follow:—

Conclusions.—We have shown, in three successive communications composing our memoir, the facts established by our researches on the eggs of different animals, belonging to all the great classes of Ovipara. Let us by way of recapitulation, endeavour to state in some general propositions, the most important consequences which seem to be the results of this first work. We have shown:—

1st. That there exist fundamental differences between the composition of the eggs of animals, and that under this collective name of *egg*, designating the product of the ovarian apparatus intended to contribute to the perpetuity of the species, very diverse bodies are comprised, different as possible from one another.

2nd. That among the vertebrated animals, the eggs of birds, of reptiles, and of fish, present in their composition, differences which the simplest analysis cannot mistake, and besides that the eggs of Sauria and Ophidia bear great analogy to those of birds, while the eggs of Batrachia resemble those of the cartilaginous fishes.

3rd. That the eggs of Arachnidæ and insects differ altogether, as to their composition, from the eggs of other animals.

4th. That those of Crustacea, organized for living in water, do not at all resemble those of fish or of other amphibious vertebrata.

5th. That this extends to the eggs of Mollusks.

6th. That these differences correspond not only to classes or orders; that they extend to natural families even, without stopping there, since we have proved that an egg of a cartilaginous fish has not the same composition with that of an osseous fish; but further, that a Carp's egg is very different from a Salmon's egg; that the egg of an Ophidian such as an adder's, does not contain the same principles as those of the Chelonia.

7th. That if the composition of different proximate principles is the same in very nearly allied species, the form and the size of vitellin granules vary in a manner sufficiently appreciable to be able to be recognised and assigned to each species.

8th. That the albuminous substances furnished by eggs of birds, reptiles, fish, crustaceans, present in their chemical properties and in their point of coagulation, differences which permit us to suppose that these bodies are made up of different proximate principles.

9th. That an egg changes its nature,—that its liquids alter considerably at different epochs of its formation, when detach-

ing themselves from the ovary, and resting in the oviduct before being hatched.

10th. After having established in the eggs of different animals, the presence of several new proximate principles, icthin, ichthulin, icthidin, emydin, and comparing these results with those which MM. Dumas and Cahours obtained in the analysis of hens' eggs, we do not hesitate to propose to science to admit the existence in eggs of a new class of organic bodies, comprising some proximate principles which we will hereafter designate under the name of Vitelline substances or Vitelline bodies.

On the Formation of Brass by Galvanic Agency.*

Copper is more electro-negative than zinc, and separates more easily from its solutions than a metal less negative. If, then, in order to obtain a deposit of brass by galvanic means, we employ a solution containing the two component metals, copper and zinc, in the proportions in which they would form brass, there will only be produced by the action of the battery a deposit of real copper: the zinc, more difficult of reduction, remains in solution. What must be done, then, to obtain a simultaneous precipitate of the two metals in the proportions required, is either to retard the precipitation of the copper, or to accelerate that of the zinc. This may be effected by forming the bath with a great excess of zinc and very little copper.

Dr. Heeren gives the following proportions as having perfectly succeeded:—

There are to be taken of	Sulphate of copper.........	1 part.
	Warm water..................	4 parts.
And then	Sulphate of zinc...........	8 "
	Warm water..................	16 "
	Cyanide of potassium......	18 "
	Warm water..................	36 "

Each salt is dissolved in its prescribed quantity of water, and the solutions are then mixed; thereupon a precipitate is thrown down, which is either dissolved by agitation alone, or by the addition of a little cyanide of potassium: indeed, it does not much matter if the solution be a little troubled. After the addition of 250 parts of distilled water, it is subjected to the action of two Bunsen elements charged with concentrated nitric acid mixed with one-tenth of oil of vitrol The bath is to be heated to ebullition, and is introduced into a glass with a foot, in which the two electrodes are plunged. The object to be covered is suspended from the positive pole, whilst a plate of brass is attached to the negative pole. The two metallic pieces may be placed very near.

The deposit is rapidly formed if the bath be very hot: after a few minutes there is produced a layer of brass, the thickness of which augments rapidly.

Deposits of brass have been obtained in this way on copper, zinc, brass, and Britannia metal: these metals were previously well pickled. Iron may, probably, also be coated in this way; but cast iron is but ill adapted for this operation.—*Mittheilungen des Hannov. Gewerbevereins*, through *Bulletin de la Societe d'Encouragement, No.* 16, *August*, 1854.

* A delicate galvanometer showed no indication of the passage of an electrical current.

The Unity of the Human Race.

Attention having been directed to this question, by some incidental observations in the May number of the *Canadian Journal*, they have been followed up by further remarks contributed to a succeeding one, designed to convey the impression of the total fallacy of arguments which have appeared to some impartial scientific inquirers, as favouring the idea of the genus MAN being divisible into several species. The writer of the present brief comment—(satisfied of the extreme difficulty of the question, touching, as it necessarily does, on the most momentous relations of man to the principles of moral government, responsibility, and divine atonement, as set forth in the sacred Scriptures)—is simply desirous of freeing the inquiry from any cumbering errors, which in the end can only work evil, whatever conclusion be established.

Premising, therefore, that nothing which is said here is intended to advocate the Non-unity of the Human Race, it is to be regretted that the author of the remarks, signed T.H.M.B., in the last number of the *Journal*, should have rested the defence of the Unity of the Race, or, in other words, the descent of all mankind from the one pair of progenitors, Adam and Eve, on arguments which will not stand the test of investigation as undisputed postulates.

1. "That the offspring of a male and female of diverse kind is barren," is *not* an established fact. Hunter and Owen, the two most distinguished of British comparative anatomists, concur in the opinion that "two species nearly allied to each other will produce a hybrid offspring, and that the hybrid is again productive with the pure breed." Mr. Bell, in his "British Quadrupeds," says—"It is well known that there are many instances of animals, undoubtedly distinct, producing young, which become fertile in conjunction with one or other of the parent kinds;" and Mr. Yarell, in his "History of British Birds," mentions various cases of fertile hybridity among birds. All these are instances produced by writers simply stating facts in Natural History, without reference to the supposed bearing of such an argument on the question of the unity or variety of human species, and it would be easy to quote additional impartial authorities. The argument is directly employed by Dr. Nott, in the "Types of Mankind," in an elaborate paper, entitled "Hybridity of Animals viewed in connection with the Natural History of Mankind," and there many additional examples are noted, and authorities cited.

2. "Experience," says the writer in the July number of the *Journal*, "teaches us that we have to fear, not the mixture of any foreign stock, but rather the continuance of intermarriages among tribes too nearly connected—*the breeding in and in.*" But here, also, he overlooks, or is unaware of the very opposite use made of this very argument as bearing on the question of original descent from one pair. The learned and pious Dr. Pye Smith refers to the idea of men being descended from more than one primary pair as "Taking away some difficulties, such as the sons of Adam obtaining wives *not their own sisters*;" and the distinguished author of the "Crania Americana," remarks in language which, though somewhat irreverent in its tone, forcibly expresses feelings in some respects akin to those of Dr. Pye Smith: "If I could believe that the human race had its origin in *incest*, I should think that I had at once got the clue to all ungodliness. Two lines of catechism would explain more than all the theological discussions since the Christian era:

> Q. Whence came that curse we call primeval sin?
> A. From Adam's children *breeding in and in.*"

These words of the learned ethnologist, Dr. Morton, are quoted, not as approving of them, but simply as showing that the writer of the remarks in the last number of the *Journal* uses, without being aware of it, and specially distinguishes by italics, the

very words employed by the earliest and ablest of all the American writers on the opposite side.

3. "Our species of the Equine Genus which we call, *par excellence,* the horse," is next advanced as exhibiting very great differences of size and shape. But to quote only a single authority, Col. Hamilton Smith, in his "Natural History of the Equidæ," arrives at this conclusion as the result of very extensive inquiries into the natural history of the horse, that horses may be separated into five primitive stocks, constituting "distinct though oscillating species, or at least races separated at so remote a period, that they claim to have been divided from the earliest times of our present zoology."

4. "The dog furnishes us," the writer in the *Journal* next remarks, "with examples even more remarkable of deviations from *his own common type.*" But here, again, the common descent of all dogs from one pair is taken for granted as an undisputed truism. Yet on what grounds? If our eye is to guide us, on what principle shall we separate the horse and the ass, not only into different *species*, but, as Gray and other distinguished naturalists do, into distinct *genera*, and yet hold as one the bull-dog, greyhound, setter, terrier, and spaniel? In truth, there is not a shadow of ground for this gratuitous assumption of the one common dog type and species. It is opposed by the ablest living Naturalists, such as Mr. James Wilson for example, without any reference to its applicability to the argument of Human Unity. It is opposed, in like manner, by all monumental and historical evidence; the paintings and sculptures of Egypt and Babylon showing the mastiff, the greyhound, the bloodhound, &c., as distinctly defined by their modern characteristics in the dawn of history as now. The wolf, the fox, and others of the *Canidæ*, are not themselves single species. Yet the wolf, fox, and jackall have been found to breed without difficulty with domestic dogs; insomuch so, indeed, that Mr. Bell, directing his attention too exclusively to one of these, inclines to the opinion that the wolf is the original source from whence all our domestic dogs have sprung.

5. "The union of the various races of human beings has always been productive of a progeny perfect in every physical function, fully capable of continuing the race." Even this is by no means the undisputed dogma here assumed. Dr. Knox, for example, in his "Races of Men," says: "No mixed race can stand their ground for any long period of years. A mixed race may be produced, but it cannot be supported by its own resources, but by continual draughts from the two pure races which originally gave origin to it," and the question, as broadly exhibited on this continent, is one of the most difficult of all the unsettled questions in physiology. It is affirmed that, alike in the half-breed Negro and Indian, a speedy degeneracy becomes apparent, along with an aptitude to diseases of a peculiar type, from which the pure races are altogether or nearly free. Certainly, it is impossible to say at present, if the coloured population of this continent keeps up its numbers, much less increases. No census discriminates between the additions it receives annually by means of a white paternity, and those directly proceeding from the mixed race. In truth, every step we take in this inquiry is on uncertain and debateable ground. Meanwhile, what is affirmed of the mixed races of men is almost precisely what does result from fertile hybridity among the lower animals.

6. Finally, the argument of the philologist is referred to, "drawn from his perception of *a single source and root of all existing languages.*" But who is the multi-lingual philologer possessed of such comprehensive perception? A vast step has been achieved in establishing the affinities of the great Indo-European group of tongues, and in tracing remoter relations connecting these with the semitic languages. But who has proved the relation between these and the Hottentot, the Australian, or the Chinook languages, or even acquired the means of testing them? Certainly no one, as yet, pretends to have done so; and, in discussing so grave and momentous a question of modern science we must build on a firmer foundation than vague generalisations, *petitio principii,* and sacred texts construed according to the preconceived ideas of the writer, with perchance as little real grounds as those formerly employed to upset the science of Geology, which now finds its foremost advocates among the Sedgwichs, Hitchcocks, Millers, and others most distinguished among the Divines and Christian layman of the age. In all honest scientific controversy the truths of sacred scripture have nothing to fear. All other truths will ultimately be found reconcileable with these. But meanwhile this new question of "The Unity of the Human Race" is not ripe for controversy. It is open only, as yet, to earnest inquiry; and it will be well for the cause of religion if our divines and theologians seek to master it in all its bearings, in the simple teachable spirit in which scientific, as well as sacred truth, can alone be mastered, before it do ripen into a controversy which will only be characterised by danger in so far as it is stamped with the intolerant spirit of ignorant assumption. The writer whose remarks have suggested the above observations, justly says:—"experience has taught us not too hastily to charge any scientific theory with being contradictory to scripture. Freedom of speculation is rightly privileged. Revealed truth is not endangered by discussion and investigation;" and it is a gratifying confirmation of this, to learn from a recent notice in this Journal that the speculations and inquiries of Agassiz on the profoundly difficult question here referred to, have in no degree diminished his reverential belief in the revelation of God through His Word.

D. W.

On the formation of a Canal between Lakes St. Clair and Erie

And the foundation of a Town and Harbour at the mouth of the Two Creeks, in the Township of Romney, in connection with the establishment of an extensive system of Drainage, by which near a Million of Fertile Acres would be redeemed in one District. With an illucidatory Map.

BY MAJOR R. LACHLAN, MONTREAL.*

(*Read before the Canadian Institute, March 10th,* 1855.)

No object being more worthy of the attention of a *patriotic* Philosophical Association than the investigation of the physical character of a country, with the view to an improved application of its natural resources and capabilities, it was with much satisfaction that I had from time to time hailed various laudable movements of the Canadian Institute, having that tendency, and especially its late exertions in conjunction with the City Corporation, for the improvement of the important harbour of Toronto. It is true that this praise-worthy course was naturally to be expected from such a Society on the very spot; but it was still not the less commendable as an influential move in the right direction, which, it was hoped would in time be creditably followed by Members of the Association residing in, or connected with, other parts of the extensive region within

* A large map of the Western District accompanied Major Lachlan's paper, exhibiting the general physical features of the country and showing in the Township of Colchester the extent and distribution of the Inland Marshes adverted to in the text. The map of the Western District, published by Maclear & Co., Toronto, may be referred to with advantage in the perusal of Major Lachlan's paper.

its range, and would ultimately lead to much good, and, in the mean time, though I could not help lamenting that our Rulers should have allowed the credit of the construction of the Sault-Ste. Marie Canal to pass into the hands of our American neighbours, I also felt justly proud of the many signal improvements either already accomplished or now in progress in the navigation of our magnificent inland waters.

While thus reflecting, I had more than once struck a chord in unison with my own feelings, and called up, with mingled sensations of pride and mortification, the recollections of long by-gone times when I had,—in vain,—been the zealous though humble advocate of various local improvements connected with the remote quarter of the Province in which I had for 10 years been a resident, and of which many disjointed memoranda have ever since remained idle in my possession.

Having ventured on so querulous a prefatory remark, it may be as well to state at once, even at the risk of being deemed egotistic, as the most natural though rather narrative introduction to the subject of this paper, that having about 19 years ago been led to emigrate with my family to Canada, and to settle in the Western District, as best suited to a constitution long accustomed to the warm climate of India, it so happened that I was in a short time placed in prominent positions that afforded me favourable opportunities for acquiring information and judging of the capabilities of the surrounding country,* which soon enabled me to perceive that the remote quarter of the Province which I had selected as my home, was "a land of great promise," both in a commercial and agricultural point of view, but more especially the latter, as being from soil and climate pre-eminently entitled to rank as the garden and granary of Canada, though, in its then neglected and mismanaged state, not soon likely to assume that prominent distinction.

I may further add that in the course of a hasty tour of observation through the Province during the previous year, I had visited Chatham by land from the London District, and and from thence travelled along the alternate marshy and sandy border of Lake St. Clair to Sandwich; from whence I made a detour by water up the river St. Clair to Port Sarnia, and back to Sandwich and Amherstburgh; and from thence by land, through the Lake-shore townships, as far as St. Thomas, by which I had good opportunities of noticing both the physical structure and actual state of that line of country.

Thus prepared—and feeling, as every true patriot possessing any local influence ought to do, under similar circumstances—it was not long before I resolved to endeavour to throw into the scale whatever weight might be in my power; and I accordingly ventured to take rather a leading part in various local good works, such as founding an Agricultural, an Emigration, and even a Literary Society, as well as advocating the advancement of popular education. In the course of these sometimes expensive "labours of love," I very soon saw the necessity of some extra stimulus being given to mercantile enterprise,—with so inviting a highway as our magnificent inland waters at our command; at the same time that I felt persuaded that without some direct encouragement from Government in the establishing of a few village harbours—were it only of *refuge*,—along the coast of Lake Erie, little could be accomplished by individuals; and I was therefore induced to make a commencing effort in *both* directions by prevailing on my fellow townsmen of Colchester to petition Government for the establishment of, at least, *one* village and small harbour, on a "Reserve," within a mile of my own property; —a project in which I at last succeeded, after several years of *official* delay. The objects aimed at will be best understood from the following extract from the Memorial alluded to. "Your Memorialists would respectfully draw the attention of Your Excellency to the remarkable fact, that while numerous ports and harbours have been long established along the opposite American Coast, the (more exposed) *Canadian* shore is still without a single port for Refuge of any kind from Amherstburgh to Port Stanley—a distance not less than 130 miles,—and that it has been justly remarked that until there shall be harbours of some kind at which Vessels can touch, neither sailing craft nor steamers can be expected to frequent our coast, far less be *built*, for the purpose of carrying on any thing like *coasting trade*, on the Canadian side of the Lake."

The bearing of the foregoing quotation may not at first be apparent, but will be readily understood when it is added that by having in the first instance devoted my attention to the outline of the Coast, along Colchester, in connection with the prevailing winds and frequent storms on Lake Erie, on the bank of which my own property lay; coupled with a rather laborious examination of a marshy tract lying beyond a gravelly ridge a short distance inland, I was thereby insensibly led to extend my thoughts to devising some inexpensive mode of *general* drainage. My first efforts however were directed to the more limited scheme, above alluded to, for reclaiming about 6,000 acres of valuable marsh land in my own Township, in connection with the Village since established in it; and I then extended my inquires as to the feasibility of introducing the same system into other Lake-shore Townships, and thereby effecting the redemption of perhaps a million of fertile acres, besides favouring the establishment of several much wanted harbours of refuge, and more especially of a very desirable one at the mouth of "Two Creeks," in the Township of Romney which I had long had at heart, and the merits of which are now to form the chief burthen of this Paper.*

But though I had thus acquired much useful and even valuable information, my disjointed memoranda on the subject would perhaps have remained unacted upon, but for my having in 1845 been agreeably roused by learning that the Municipal Council of the District had petitioned Government for a preliminary survey, in behalf of one of the very objects which I had so long in view,—namely, the establishment of a harbour at the mouth of Two Creeks, but unfortunately, it appeared, without furnishing any documents or arguments demonstrative of its feasibility. Finding such to be the case, I lost no time in addressing a long official letter to Mr. Secretary Higginson in support of the Council's Petition, in which I endeavoured to supply such information as I deemed desirable.†

The nature of the reply vouchsafed by the Government to the very reasonable appeal of the Municipal Council I know not. With regard to my own efforts it will for the present be sufficient to premise that though my letter was very flatteringly acknowledged by the Governor-General, on its being referred to the Commissioner of public works for his opinion, and "weighed in the balances" opposed to the great "*Rondeau*" BUBBLE, "was found wanting" and, as such doomed to

* First as Sheriff, and afterwards as Magistrate and Chairman of the Quarter Sessions.

* See the prefixed map, or any good map of the Western District.

† Though savouring somewhat of egotism, it is but justice to note, that having been personally known to the Governor-General in India, I had been condescendingly honoured with an invitation to submit to him at any time whatever suggestions I might think would be beneficial to my adopted Country.

oblivion in that "Tomb of all the Capulets" the shelves of a Secretary's Office,—though not without a last effort to shield it from premature condemnation, from either any *blunders* on my part, or any misapprehension or misapplication of my meaning, as will be found noticed in its proper place.

Such however would doubtless have continued to be the fate of my long cherished disinterested exertions, but for the onward march of mind having at length given birth to a more satisfactory, because independent public arbiter, through whom the merits of all scientific and useful projects can now be investigated and duly appreciated,—though it may not have the power of carrying them into effect.—Need I add that I allude to the auspicious institution of the Canadian Institute of Toronto.—At all events, I can sincerely state that feeling persuaded that such would be the guiding motive of that association, and seeing it exemplified in more than one instance, besides its laudable movement in behalf of the Harbour of Toronto, all my old feelings on the subject of my long dormant patriotic project revived, and led to an endeavour to recover a copy of my letter to Mr. Higgenson; and having succeeded, I was at one time inclined to place that document at the disposal of the Institute, "without note or comment," but on second thoughts I deemed it more advisable to alter the form of my statements so far as, by a few modifications and additions, to make them assume something of the shape of a regular paper, though still partaking more of the character of a simple narrative of facts than an elaborate Essay:—and accordingly in that desultory form are the following particulars respectfully submitted. Feeling however that something more was wanting, I have taken the trouble of preparing and prefixing thereto a large scaled sketch map of the Southern portion of the Western District, as likely to prove of assistance in correctly comprehending the different bearings of the subject, but more especially, as regards the drainage of the Township of Colchester. And I am also willing to confess that in taking that step at this particular time, I was not without hope of thereby drawing the attention of "*The General Drainage Society of Upper Canada.*" about to be incorporated, towards a part of the Province furnishing so attractive and profitable a field for their patriotic operations.

Trusting that these introductory remarks will not be deemed altogether misapplied, I now proceed to state,—as observed in the letter above alluded to, and from which I am about to quote almost verbatim, that my attention having (in 1845) been unexpectedly drawn to a petition from the Municipal Council of the Western District to the Governor General, praying for *a Survey*, to ascertain the practicability of forming a harbour at the mouth of "Two Creeks," in the Township of Romney, and at the same time opening a communication from thence either by *Canal* or *Road*, to some point on the River Thames, but without furnishing any specific data from which Government might be encouraged to give a favourable answer to their prayer, and having observed the same project strongly advocated by a well-informed though rather over-sanguine correspondent of "*the Patriot*," from Chatham, I was induced to throw whatever might be the weight of my humble advocacy of so patriotic a proposal into the scale, in the hope that the additional information which I happened to be able to furnish would ensure the matter being not only brought pointedly before the Governor General, but patronised to an extent beyond the hopes of either the Municipal Petitioners or the writer alluded to.

Impressed with these feelings I took the liberty of stating that it so happened that the undertaking in question had been regarded by me as a great *desideratum*, ever since my arrival in the Country, and that my progressive enquiries on the subject, in connection with a plan for the general drainage of a large and valuable portion of the Lake-shore Townships, (which I proposed to form the basis of another communication)* rendered me not altogether unqualified for giving a well-grounded opinion as to the feasibility of the project, as well as to the prospective public benefits derivable therefrom. In stating thus much, however, I did not wish it to be inferred that I laid any claim to being the originator of the idea, the truth being that I had noticed it broached some 8 or 9 years before in some publication on Canada, in a letter written by Mr. William Elliott of Sandwich, (then I believe member for the County of Essex), when I was so struck with it, that I was, from time to time, induced to make memoranda on the subject, for future reference,—of one of which the following is the substance.

"Mr. Elliott of Sandwich observes that much advantage to the Western District would be derived, could a Canal be made *from the first fork of the Thames to Lake Erie,* near the Romney Township line; and is of opinion, from information obtained from others, and his own observation, that this would be practicable at an expense truly tifling, compared with its advantages, and the quantity of fine land that would be thereby reclaimed, amounting to at least a million of acres! Were the waters once made to take this course, it would of itself soon wear it to a level with Lake Erie, and thereby lower the waters of Lake St. Clair, if not reduce it to a river.† Were this effected, much of the Government and Canada Company's lands in Harwich, Raleigh, Tilbury, Rochester, and Maidston, would be drained by it, besides much other land, which, without something of the kind being done, must remain a Marsh, particularly the fine plains at the mouths of the rivers St. Clair and Thames."

My attention having been thus attracted towards a project pregnant with such great public benefits, it had ever since been more or less kept in view during my visits to the various localities alluded to; and, though unable to keep pace with Mr. Elliott's sweeping conclusions and sanguine expectations, I had thereby become so satisfied of, not only it feasibility, but its certain utility and value as a public work, that I made up my mind to publish a few desultory observations in its favor, but was long deterred from attempting it by the unsettled state of the political horizon. The matter having however been at length unexpectedly mooted by the Municipal Council of the District, I determined not to run the risk of its merits not being properly appreciated, for want of either sufficient preliminary data (such as I happened to possess) or my own humble testimony in its behalf.

Having thus introduced the subject, I next proceeded to refer to the letter‡ alluded to, (a copy of which is here annexed),

* It may be necessary to note that the reception which my letter met with completely extinguished any desire to fulfil the intention mentioned.

† The level of Lake St. Clair is a little more than 5 feet above that of Lake Erie.

‡ The excellent letter above alluded to, was as follows: "Sir, Through the medium of your Journal, I beg leave to call the attention of Merchants and Traders to a subject of the greatest importance to their interests,—a subject which was mooted at the last Session of the Municipal Council of the Western District, and which has for its object the uniting of the waters of Lakes Erie and St. Clair, by means of a Canal between the mouth of the River Thames and what is called "Two Creeks," in the Township of Romney, on Lake Erie. The whole distance across in this direction is 15 miles, and 23 chains and 45

as having appeared in the Toronto *Patriot;* and added that I heartily concurred in many of the writer's remarks, though in some instances a little too sanguine, and in others he overlooked arguments in favour of the project which I might perhaps take the liberty of supplying; but that in the mean time I might remark that the writer was evidently neither a military nor naval man, otherwise he would not have altogether overlooked the great advantage that would result, *in the event of War with the States*, from our thereby possessing so much additional *internal* navigation, and having the control of the waters of Lake St. Clair, in case of any hostile movement from Detroit.

I then proceeded to state that in addition to less *direct* information, picked up at intervals, relative to the suggested line of canal, and the great natural capabilities of the mouth of "Two creeks" for being converted into a superior harbour, I had then lying before me a minute profile of the levels of the very tract of country through which the former was proposed to pass, which had been in my keeping several years, and to which I had, after a careful examination of the details, attached the following memorandum:—

"Memorandum regarding the levels of the country between the mouth of the Thames and Lake St. Clair on the north, and Lake Erie on the south; as applicable to the feasibility of cutting a canal between the two Lakes in that direction.

"From the data furnished by an elaborate *Profile* (from actual survey) of the proposed line of canal from a creek and marsh on the north shore of Lake Erie, (inferred to be *Two Creeks*, but not expressly so stated) to Jennett's Creek, at the mouth of the River Thames, on Lake St. Clair, by A. E. Hathon, Esq., Engineer, (executed about eight or nine years ago), it would appear that the surface of Lake St. Clair is 5¼ feet higher than that of Lake Erie, and that the direct horizontal distance between the two Lakes is 1,140 chains, or about 14¼ miles,* and that from Lake Erie the land has a gradual ascent for between four and five miles, until it has attained its greatest elevation or summit level of 38¾ feet above the lakes, when it descends gently for more than four miles to a black-ash swamp and creek (not named) about sixteen and a half feet above the lake; after which there is a slight sudden rise of about three feet, after which it resumes a continued gradual slope during the remaining third of the distance until it meets Jennett's Creek (at a point not definitely explained) on the same level with Lake St. Clair. The nature of the surface *soil* is nowhere particularly noted; but it would appear to be free from rocky impediments; and its general superior character, as regards agriculture, may be inferred from the forest with which it is described to be clothed, consisting of varieties of hardwood, indicative of fertility, such as black-ash, elm, red and white oak, maple, hickory, and beech."

Having thus furnished the data from which I had been led to assume that the opening of a canal or cut between Lakes Erie and St. Clair, at a moderate expense, was quite practicable, I next referred to the following memorandum respecting the equally easy conversion of the mouth of Two Creeks into a "first-rate" harbour for any reasonable number of vessels, as gathered from two highly intelligent friends residing in the neighbouring Township of Gosfield, who were familiarly acquainted with its locality; adding that there were not a few other well informed persons in that quarter who regarded Two Creeks as not only superior to the Rondeau as a safe and sufficiently commodious harbour, but a far more eligible site for a village, the latter sheet of water being so very extensive as to partake more of the character of an open road-stead than a shelter harbour, and at times agitated by waves of such magnitude as to place small craft in no little jeopardy; and the neighbouring land being in general low and marshy; whereas the proposed harbour at the mouth of Two Creeks is described as well sheltered on all sides, and the village site on the point of land at the junction of the two branches high and dry, and otherwise of a very agreeable aspect, as demonstrated in the following "Descriptive Sketch:—"†

"The name of Two Creeks is derived from two branches

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links, and the difference of level in the waters about 8 feet (taken from a Survey made some years ago.(*a*) By throwing the eye over a Map of the district, the immense advantages which such a channel of communication would produce are immediately seen. Vessels navigating the upper lakes would save a distance of from 125 to 150 miles, and that of the most dangerous part of the voyage. Three-fourths of the vessels which go up the Detroit River, passing by that City, and even those intended for that Port, would gain by the proposed improvement, in as much as Vessels are often wind bound for days together at the mouth of that River, to the great detriment of trade and loss to the owners.(*b*) To Propellors, which will no doubt very soon supersede the sail craft on our Lakes, it will make a material difference in the article of fuel. Those boats are particularly adapted to our narrow and deep streams and when used by us will have the effect of adding to our inland navigation some 300 miles through a country abounding with the choisest woods, with a soil unsurpassed in richness and fertility,—the destined granary of the Province. The contemplated project would facilitate trade and navigation, by affording a cheaper, safer and speedier route,—objects of no small importance to those whose means are limited. It would be a link in the chain of improvements now going on in the Province; and, instead of detracting from, would add to their general utility and profit, by increasing the means of transit, and thereby bringing the productions of the "Far West" nearer to market; a desideratum most essential to the settlement and growth of the country, as well as to the development of its resources. One of the difficulties which its present inhabitants have to contend with would be removed, encouragement would be held out to the industrious, and new energy imparted to every part of the province. Capital would be safely invested in a thousand ways, with the certainty of an ample and sure return: and the Farmer would not only obtain a better equivalent for his labours, but the necessaries of life, being cheaper would be more available, and the luxuries of life would sweeten its cares.—The Municipal Council have addressed His Excellency on the subject, requesting that a Survey may take place, and a report be made thereon, under the control of the Board of Works. A question of such moment, it is to be hoped will not be lost sight of by the Merchants of Toronto, and Kingston; but that on the contrary they will canvass its merits and demerits. Several eminent Engineers have pronounced the work practicable: and that it would be profitable there is no doubt. Trade is every year increasing. The project is not visionary, but real; and all that is wanted is a united effort to consummate it. (Signed,) Y. Z.

(*a*) There is probably some mistake here; the distance according to my memorandum being 14¼ miles, and the difference of level between the two lakes only 5¼ feet. See Note R. L., as below.

(*b*) This, owing to the great prevalanee of N.W. and N.E. winds is often exemplified in from 20 to 30 vessels being at times seen at anchor for days together, waiting for a fair wind, both at the mouth of the Detroit and in Lake St. Clair,—presenting to the idle spectator a very interesting view of these "Musquito Fleets" taking a bustling advantage of the first puff of a favourable breeze.—It may also be here added that so rapid is the deposition of sediment in Lake St. Clair, from there being no perceptable current, that it is inferred by many that it will ere long assume the form of a regular River, bordered by broad marshes. How far this will tend to fill up, or to deepen the few narrow navigable channels now available may be a question.—But it is a fact that at the mouths of the Rivers that fall into it, it is difficult to discern whether the water flows out or in, and that there is generally a greater depth within their mouths than outside. R. L.

* This is about two miles less than from Chatham to Shrewsbury, on the Rondeau, which by the plank-road is about sixteen miles.

† It may be proper to add, with regard to the Rondeau, that the large natural basin, so called from its being of a round form, is situated on the western side of a long projecting point of low land, named Point aux Pins, and consists of about 6,000 acres, with a depth of from ten to eleven feet, but so unsheltered--the surrounding marshy tract being

happening to unite within 100 yards or so, of the beach of Lake Erie. The western one is small, shallow, and marshy towards its mouth; but the eastern or main one, which is peculiarly calculated to form a commodious harbour, capable of containing 100 vessels, consists of a fine clear channel, from twelve to sixteen feet deep, and about twenty rods wide, extending full half a mile inland, besides being skirted to the eastward by a marshy bay of less depth, about 100 yards wide, the mass of vegetation on the surface of which being known to rise and fall with the level of the water in the creek, might easily be broken up, and floated down into the lake, and thereby add much to the capacity of the harbour. The land on the east side of this bay is low; but that on the west side of the east creek forming the point between the two branches, and also the right bank of the west branch is high and commanding, and well suited for a village site, being from twelve to sixteen feet above the water level, with steep banks on both sides, and covered with stately hard-wood forest. The soil also is good, being a light colored sandy loam, resting upon yellow clay; and there is no indication of rocks or stones in the neighbourhood. The Talbot road crosses both creeks about one mile and a half inland, where the banks of the east branch are about thirty yards apart, and ten feet deep, with a stream in the middle about thirty feet wide, and two deep. As already observed, from the point of land at the confluence of the two creeks to the beach of the lake is about 100 yards, and the mouth is sometimes obstructed by a dry sand-bank or bar, formed by the wash of the surf; as was the case when visited by my informants in the month of May, at which time it was about three feet above the level of the lake, and about thirty yards across. The lake off the creek deepens rapidly, there being sixteen feet about fifty yards from the shore; but there is a small shoal about 100 yards further out. Beyond that, however, there is uninterrupted deep water, from three fathoms upwards."

As a striking instance of the facility with which a channel may be cut through the sand bank at the mouth of the creek, it may be mentioned that on the occasion alluded to my two friends happening to stop there in the evening with a loaded boat, they amused themselves with scooping out with their hands a very small channel, so as to allow the water to flow off towards the lake; and that in the morning they were not a little astonished to find an opening through which they were not only able to take their boat, but of such breadth and depth as to have admitted a schooner of considerable burthen.

To be continued.

very little above the level of the lake—that vessels, after effecting an entrance are, in a gale, liable to drag their anchors and run aground on the mud. It will, therefore, perhaps, not be wondered, that after an expenditure of from £25,000 to £30,000 of the public money in the attempt to convert the Rondeau into a safe harbour, and laying out the town of Shrewsbury on its north side as a port of entry, it was judged expedient to abandon the undertaking, and transfer the unfinished works to a private Company, by whom they have been allowed to go to decay, while so unproductive have the harbour dues and customs proved that they have seldom defrayed the expense of collection. Add to which, by late accounts, (1853), the location of the town has proved nearly a failure; and the light-house at the point not having then been lighted for a year, several vessels had been stranded outside the harbour. Should, however, the plank-road between Chatham and Shrewsbury be completed, and a line of steamers be established between the Rondeau and Cleveland, there may yet be great changes, as though the neighbouring marshes are very extensive, their immediate connection with the lake produces a constant flux and reflux in their waters, which in a great degree counteracts any miasmatic influence.

Remarks on the Flavouring of Confectionary.

In the last number of the *Journal*, in a paper on Food and its Adulterations, abridged from the *London Quarterly*, reference was made to the use of certain substances now extensively employed in giving peculiar flavours to various kinds of confectionery, and thus successfully imitating those of different fruits. The author, in endeavouring to excite a prejudice against their use, says:—"All these delicate essences are made from a preparation of æther and rancid cheese and butter."

The fact is certainly true, but it may be doubted whether it is a fair line of argument to attempt to create disgust against any particular substance by referring to the sources from which it is obtained. The various chemical processes and operations to which the original matters are subjected, should be described at the same time, and it would then appear that the result is of a perfectly pure character, and bears not the faintest resemblance to the sources from which it has been obtained.

No one objects to eat vegetables, or fine hot-house grapes, although common manure is not an enticing article, and grape growers much delight in dead horses for their vine borders.

But a much more forcible argument against the validity of this objection is to be found in the fact, that one of the most curious discoveries of modern chemistry is the existence in plants, flowers and fruits, of certain flavouring principles which on examination are found to be of precisely the same nature as the substances artificially prepared for the above mentioned purpose. Several cases of this kind have been discovered, of which we need only mention a few:—the sweet scent of the Winter Green is owing to the presence of Salicylate of Methyle, a compound possessing all the characters of an *æther*. The flavour of the Quince is owing to Pelargonate of Æthyle, another perfect æther, which, like the former, can be readily prepared in the laboratory. I am not aware that the essence of the pine-apple has been separated in a pure state, but there can be but little doubt that it is Butyric Æther, or at any rate an æther of one of the analogous volatile fatty acids. Butyric acid itself (derived from "rancid butter") is found in the "St. John's bread," (the fruit of *Ceratonia Siligna*,) so that Dame Nature seems as liable to the same objection as the confectioners.

Several other instances might be adduced, but the above will suffice to show the probability of our artificial flavourings being in many cases absolutely the same as those existing in the natural products. This certainly does not hold good with all, the artificial essence of Ratafia (Nitrobenzide) is purely a product of manufacture and only resembles the oil of bitter almonds in its smell, it remains to be proved, however, that it is injurious in its effects, a priori one would judge it to be less hurtful than the crude oil or its preparations.

H. C.

New Expedition into Central Africa.*

The limits of the great unexplored region of Africa may be roughly indicated by the parallels of 10° north and south from the equator, and extending from Adamaus in the west to the Somanli country in the east. This extensive region is just touched by the routes of South-African explorers, Livingston and Lacerda,—and by the Abyssinian travellers, by Barth, Overweg, Vogel, and the Chadda Expedition in the north. The greatest inroad into this unknown region has been made by travelling up the Bahr el Abaid, or White River, on which and along which there has been a continuous tide of explorers since 1835, when the Egyptian Government despatched an Expedition up

* Athenæum.

this river,—which was followed by several others of the same kind, as well as by Austrian Catholic missionaries, by many traders and adventurers. The extreme points reached on this river by any of the travellers lay between 4° and 5° north laitude.

At the westernmost bend of the Bahr el Abiad, in about 9° 10′ north lat. and 29° 15′ east long, this river opens out into a rather ill-defined lake or marsh, by some called No, or Nu,—by others, Birket el Ghazel, —by others still, Lake Kura. Its circumference seems to vary at different times; and M. Brun Rollet in 1851 found it of very small dimensions. Into it, from the west, according to a variety of sources, is said to run an immense river, formed by two large branches, of which the one has a westerly or W. N. W. direction; the other one from the south-west. The name of the latter is mostly given as Bahr el Ghazal, Bahr Kulla, or Misselad,—the latter names being also applied to the united main stream. The head waters of these rivers are supposed to extend to the borders of Waday, Bagirmi, and even Adamaua. But so little is known of the region thus described as the basin of the river received by Lake No, that nothing can be stated with any degree of certainty, except that certain rivers exist there, and that these rivers belong to the basin of the Nile. Thus, Dr. Barth, from information he received while in Bagirmi, from persons on whom he had reasons to place reliance, lays down a river called Bahr il Ada in about 7° north lat. and 22° east long. Greenwich, running eastward. In a report from Cairo, dated the 22nd of October, 1843 (see *Augsburgh Zeitung*, Nov. 18, 1843), it was stated that a German traveller had been in Darfur, thence travelled for seven days due south, and came upon a river, on which he embarked, and on it ultimately reached the White River. This may or may not be true:—our present information relating to that region is altogether vague and uncertain. The extreme point reached by Europeans on the north side is Kobeth, the capital of Darfur, in 14° 11′ north lat. and 26° 55′ east long. Greenwich,—first visited by Browne in 1793. The furthest point reached by Barth (or any other European) from the west is Masena, the capital of Bagirmi, the position of which may be taken at 11° 40′ north lat. and about 16° east long. Greenwich. When in Bagirmi, Dr. Barth collected an immense amount of information respecting the countries between it and the Nile, which information he connected and laid down on the map. It relates, however, more particularly to the region east and north-east from Masena, in the direction of Khartum, along the various caravan and pilgrim roads, which, unfortunately, do not extend in the direction of Lake No or south of it. The distance between Masena and Lake No nearly amounts to 800 geographical miles, being equal to that between Kuka and Timbuktu.

The feeders of Lake Tsad Dr. Barth traced to about 18° east long.; there a broad mountainous region extends from north to south, which, it is little doubtful forms the line of waterparting between the basin Lake Tsad and that of the Nile, and gives birth to the rivers running into the Bahr el Abiad at Lake No.

It is from Lake No that the New Expedition is going to penetrate to the westward, up the Bahr el Ghazel. This Expedition is fitted out by, and under the direction of, M. Brun Rollet, a Sardinian, who for the last twenty-three years has been residing in Khartúm, chiefly engaged in mercantile pursuits. This gentleman has already ascended the Bahr el Abiad several times from Khartúm as far as 5° north lat.,—of which explorations a full account will shortly be published. As may be supposed, Mr. Brun Rollet is intimately acquainted with the countries of the White River, its inhabitants and natural resources. He has been very successful in his mercantile transactions, particularly in ivory and gum, so abundant in those countries,—the yearly export of the former amounting at present to about 800 cwt. But he has reasons to know that the country he now proposes to explore is much richer in that and other articles of commerce. This Expedition will consist of six boats, manned by about sixty men, all well armed. M. Brun Rollet is strongly built and inured to the climate, of scientific attainments, and has been aided in his scientific outfit and preparations by the *savans* of Paris and Turin. The Expedition is entirely a private one, and undertaken by his own means, the French and Sardinian Governments having given him special letters of recommendation to the Pasha of Egypt.

M. Brun Rollet is at present in Cairo, and will shortly start for Khartúm, where his final preparations will be made for the ascent of the Bahr el Abiad and Bahr el Ghazel, in the direction of Waday. It may be noticed that the latter river has mostly been called Kellak in late years; but I am informed by M. Brun Rollet that the Arabs and the black natives of those countries do not know it under that name, but principally by that of Bahr el Ghazel, sometimes Misselad.

AUGUSTUS PETERMANN.

Royal Geographical Society.

At the last Anniversary Meeting of the Royal Geographical Society (May, 1855.) the report stated that the Patron's gold medal has been awarded to Dr. Livingston for his recent explorations in Africa, between Lake Ngami and the Portuguese settlements on the west coast; and a testimonial of the value of 25 guineas in surveying instruments, bearing a suitable inscription, to Mr. Charles John Anderson, for his travels in south western Africa, as laid down in his route-map communicated to the society. The Bishop of Oxford, in moving the adoption of the report, said, the award of the gold medal to Dr. Livingston, a friend of his own gave him indeed great pleasure, for he had been the means of introducing commerce and civilization to the uncivilized parts of the earth. As a minister of religion he had been the pioneer of art, commerce, and civilization. In geographical discoveries in many parts of the world they had followed the same tract as here, leading to the highest purposes of humanity and civilization. One of the most remarkable instruments used by Dr. Livingston was contained in his reducing to writing the language of the barbarous and uncivilized nations of the earth, and by their written language conveying the truths of Christianity to the uncivilized people. As Dr Livingston was the first man of their blood who had crossed the great continent of South Africa, most heartily did he congratulate the members of the Royal Geographical Society that their gold medal had gone into such hands.

The Earl of Ellesmere in his annual address, commenced by adverting to the members of the society who had been removed by death during the past year. First in importance was their friend and associate, Sir John Franklin, the hero and victim of the Arctic regions, for which service he had been trained almost from his youth. He suffered shipwreck in 1807, and honourably served under Nelson at Copenhagen and Trafalgar, and was one of six out of 60 who, standing on the poop of the Bellerophon, escaped unhurt. He served under Cornwallis and St. Vincent, and, although wounded, after his gallant services in war the harvest of his fame was still to be won. He was employed in America from 1809 to 1820, and by his services 1,200 miles of coast were added to the map of the British possessions. The sad details that had reached them left no room for hope, preceded as that intelligence was by the sacrifice of the gallant Bellot, which melancholy event inaugurated the alliance now happily existing between his own and this country. As long as the name of Franklin should be known, it would be venerated and admired After passing some warm eulogiums on the excellence of the late General Sir Andrew Barnard (Governor of Chelsea Hospital), Mr. Joseph Hume, Rear-Admiral Price, Colonel Lloyd, Sir Henry de la Beche, Mr. G. B. Greenough, Lord Dudley Stuart, and Lord de Mauley, he proceeded to comment on the advances that has been made in the acquirement of geographical knowledge during the past year. Since their last annual meeting Captain Collinson had returned in the Enterprise, having left his country in 1849, but had not added much to their geographical knowledge of the Polar Seas. By Dr. Rae's intelligent discoveries of the relics of Franklin's expedition there could be no doubt as to his melancholy fate, but still he hoped that further light would be thrown upon the subject by means of the Hudson Bay expedition. In allusion to the Arctic question he might observe that plans for the monument to Lieutenant Bellot had been submitted by the council, and it would shortly be erected near Greenwich Hospital. He also alluded to the opening of the trade between the United States and Japan, after all intercourse with the latter country had been closed for nearly two centuries. Having adverted to some other topics, in conclusion, he thanked the members for the indulgence they had shown him while he occupied the presidential chair, and announced, as his successor, Admiral Beechy, who would amply supply any deficiency they might have sustained.

Wheat from Ægilops *

The announcement by Prof. Dunal, of Montpellier, two or three years ago, that M. Fabre, of that vicinity, had converted *Ægilops triticoides* into wheat, by cultivation for several generations, excited a lively sensation, which has not yet subsided. Prof. Dunal appears to have satisfied himself that *Ægilops triticoides*, or rather its ancestor, *Æ. ovata*,—a common grass on the southern coast of France,—is the original of wheat, and Prof. Lindley has adopted this opinion. This, if true, would be the only instance in which any one of the staple cereal grains has been identified with a wild original. Dunal's published account has called forth many detailed discussions, in which vari-

* American Journal of Science and Art.

ous views have been maintained; but at length a few simple experiments of M. Godron of Besancon appear to have disposed of the question. M. Godron's paper is published in the *Annales des Sciences Naturelles*, vol, ii. for 1854, No. 4. He remarks, in the first place, that the so-called species, *Ægilops triticoides*, is only of sparse and occasional occurrence; that it is seldom if ever found except in the vicinity of wheat fields, and in the districts where *Æ. ovata* abounds as a wild plant; that intermediate states between *Æ. ovata* and *Æ. triticoides* do not occur, as they are apt to do between races or varieties of any species; but that *Æ. triticoides* itself varies in certain respects and according to the kind of wheat which is cultivated in the neighborhood; and finally, that the wild *Æ. triticoides* usually produces very little seed. From these considerations he was naturally led to suspect *Æ. triticoides* to be a hybrid, resulting from the accidental fecundation of *Æ. ovata* by the pollen of wheat. And this conclusion he has verified by direct experiment; that is, he has raised *Æ. triticoides* from seeds produced by impregnating the ovaries of *Æ. ovata* by wheat pollen. At the same time, and in the same manner, M Godron produced a new and analogous hybrid by impregnating *Ægilops triaristata* with the pollen of common wheat; as well as another by impregnating *Æ. ovata* with the pollen of *Bearded Spelt* (*Triticum Spelta, barbatum*). It seems, therefore, most probable that M. Fabre's Ægilops-wheat owed its origin to the accidental fertilization of the *Æ. triticoides* experimented with—itself a hybrid between wheat and *Æ. ovata*—by the pollen of its male parent, wafted from adjacent wheat-fields; the cross-breed returning to the male type in the usual manner under such circumstances.

This evidence, however, does not convince Dr. Lindley; who objects that M. Godron and others have not explained what the origin of wheat has been, if it is not a domesticated condition of *Ægilops*;—an undertaken which we must say is by no means incumbent upon M. Godron, who had accomplished his object when he has shown, as he has clearly done, that M. Fabre's famous experiments do not prove Ægilops to be the original of wheat;—although in his opinion the two should be ranked in the same genus. Can Dr. Lindley indicate the wild original of Maize, Rye, Barley, or Rice? And does the fact that the originals (if they indeed exist) are unknown, render it any more likely that these cereal grains are the progeny, in altered guise, of some other known Gramineæ?

The late Assyrian Expedition.

Col. Rawlinson has arrived in London from Bagdad, having brought to a close the excavations in Assyria and Babylonia which he has been superintending for the last three years on behalf of the Trustees of the British Museum. The results of these excavations have already in part reached the Museum, but the most valuable portions of them are still in transit. One hundred and fifty cases containing sculptures, inscribed tablets, terra-cotta cylinders, and a very large collection of small objects of Assyrian Art, were recently unpacked at the Museum. One perfect obelisk, and the fragment of a second, are the only objects of this collection which have been yet exhibited to the public in the Assyrian Gallery; but the inscribed tablets, which amount in number, we believe, to at least 10,000, the two fine cylinders from Kileh Shergat, and all the smaller relics—which, for better security, are deposited in closed cases—can be examined by the curious. A collection of almost equal extent and of greater value—inasmuch as the sculptures belong to the culminating period of Assyrian Art, and are infinitely superior to those which form the present Nineveh Gallery at the Museum—was shipped last month at Bussorah, and may be expected to reach the Thames in August or September; while a third or supplementary collection, composed of select specimens, the master-pieces of Assyrian Art which were disinterred from the new Palace at Nineveh during the past autumn and winter, is about to be brought to Europe, in virtue of an arrangement concluded between Col. Rawlinson and M. Place on board the Manuel, a vessel which was sent out by the French Government for the purpose of bringing home the collections of M. M. Place and Fresnel. Col. Rawlinson has further brought with him over-land a single small case, containing, among other relics of especial interest, the Nebuchadnezzar cylinders which he obtained from Birs Nimrud in the autumn of last year, and those still more valuable cylinders of Nabonidus, the last king of Babylon, which record the name of that monarch's eldest son Belshar-ezer, the Belshazzar of Daniel. It is sincerely to be hoped that means will be found for exhibiting these slabs to the public, as soon as the whole of the three collections shall have arrived, either by a new arrangement of the present Assyrian Gallery, or by the allotment of fresh space to the Antiquity Department of the Museum. Unless, indeed, some measures of this nature are taken, the fruits of the late Assyrian Expedition, of which the labours are now brought to a close, will be lost to the great majority of the nation,—the number of those who can appreciate the historical and scientific results, obtained from so vast an accumulation of cuneiform materials, being, of course, comparatively few.—*Athenæum.*

The Sault St. Marie Canal.

The leading demensions of this important link of communication between the Ocean and the Lake Superior regions are as follows:—

Its length is one mile and an eighth, its width 70 feet at bottom, and 100 at water line, depth 12 feet, and of sufficient capacity to admit steamboats of 2,000 tons burden, and larger than can pass up the St. Mary's River. This is sufficiently large for all the trade that will be carried on through it for years. If there were a ship canal round the Falls of Niagara of equal capacity, and a few thousand dollars expended in improving the navigation of St. Clair Flats and St. Mary's River, a steamer of 2,000 tons might make an uninterrupted passage from Liverpool to Fond du Lac, at the head of Lake Superior.

The Locks are deservedly admired on account of their beauty, durability and perfect manner in which the stone and workmanship had stood the test of a rigorous winter. The gates are of massive construction, but work with great ease, and being of vast strength, and securely fixed in their places, and stayed by numerous iron braces, four inches square, running down into, and anchored below the stone work, they can hardly be supposed to give way. They are easily handled by two men.

It is anticipated that the slope of the walls, (45 deg.) will interfere with the passage of side-wheel steamers, especially when the wind is blowing fresh, to obviate which difficulty, snubbing posts have been set a distance of four hundred feet apart on the tow-path side, and two hundred feet distant on the river or heel-path side, and the State Engineer is of opinion that a large scow will be required to keep the side-wheel crafts off the banks.

The present State tariff of tolls, is fixed at a minimum of four cents per ton, measurement, which would give on an ordinary schooner, from $10 to $15; on a brig, from $17.50 to $20; on a large propeller $30, and on side-wheel steamboats, from $40 to $50.

The means of getting boats and propellers through the Canal, is of course by the use of their wheels, but sail vessels will require to be towed, and for that purpose horses will be required, the expense of towage falling, of course upon the vessels. A wide and handsome tow-path has been made upon the right bank of the work, and a corresponding heel-path upon the left bank.

On the twenty-first May 1855, the day on which the State authorities were upon the work, there was 12 feet 8 inches of water at the head of the upper pier, and 12 feet 5 inches in depth in the lower lock, consequently any vessel, no matter how heavily laden, which has ever navigated the western waters, could pass up and down with ease, as the locks are seventy feet in width, and three hundred and fifty feet in length, in the clear. The average class of steamers do not draw over nine feet, loaded.

The artificial walls, or banks of the canal are from seventy to one hundred feet in thickness at the bottom, and thirty-five feet at the high water line, standing on both slopes at an angle of forty-five degrees, lined with dry stone work on the sides inward.

The aggregate lift of the locks, is seventeen feet six inches.

Use of Lime-Water in the Formation of Bread.

To neutralise the deterioration which the gluten of flour undergoes by keeping, bakers add sulphate of copper or alum with the damaged flour. Professor Liebig, however, has conceived the idea of employing lime, in the state of solution, saturated without heat. After having kneaded the flour with water, and lime, he adds the yeast, and leaves the dough to itself; the fermentation commences, and is developed as usual; and if we add the remainder of the flour to the fermented dough at the proper time, we obtain, after baking, an excellent, elastic, spongy bread, free from acid, of an agreeable taste, and which is preferred to all other bread after it has been eaten for some time. The proportions of flour and lime-water to be employed are in the ratio of 19 to 5. As the quantity of liquid is not sufficient for converting the flour into dough, it is completed with ordinary water. The quan-

tity of lime contained in the bread is small—160 ounces of lime require more than 300 quarts of water for solution; the lime contained in the bread is scarcely as much as that contained in the seeds of leguminous plants. Professor Liebig remarks that "it may be regarded as a physiological truth, established by experiment, that corn flour is not a perfectly alimentary substance; administered alone, in the state of bread, it does not suffice for sustaining life. From all that we know, this insufficiency is owing to the want of lime, so necessary for the formation of the osseous system. The phosphoric acid likewise required is sufficiently represented in the corn, but lime is less abundant in it than in leguminous plants. This circumstance gives, perhaps, the key to many of the diseases which are observed among prisoners, as well as among children whose diet consists essentially of bread. * * The yield of bread from flour kneaded with lime-water is more considerable. In my household, 19 pounds of flour, treated without lime-water, rarely give more than 24½ pounds of bread; kneaded with 5 quarts of lime-water, the same quantity of flour produces from 26 pounds 6 ounces to 26 pounds 10 ounces of well baked bread. Now as, according to Heeren, 19 pounds of flour furnish only 24 pounds 1½ ounces of bread, it may be admitted that the lime-water bread has undergone a real augmentation."—*Annalen der Chemie und Pharmacie*, and *Chemist*, March, 1855.

Photography.—Employment of the Cyanid of Iodine.*

M. Stephane Geoffray, Advocate at Roanne, and a great amateur in the art of photography, has employed with success the cyanid of iodine as the sensitive agent in direct positives. This compound he obtains by the action of iodine upon cyanid of mercury. It is very soluble in a solution prepared with wax and benzine, and gives to this coating a rapidity of action nearly equal to that obtained by the use of ceroleine. Applied to collodion in the proportion of other iodids, the cyanid uniformly affords direct positive proofs of great beauty and which do not subsequently change. After fixation in the old bath of hyposulphite, the lights become very beautiful and are not inferior to those given by the use of the sesquichlorid of mercury.

M. Geoffray also employs the sesquichlorid of iron for all the purposes for which the sesquichlorid of mercury has been hitherto used, to bring out negative proofs on collodion and upon albumen in the manner employed for direct positives. He also employs this agent in place of the iodid to prepare sensitive papers for making positives in the shade and in a few seconds; according to the process of M. Blanquart-Ewrard. With this chlorid he also prepares a dry collodion of excellent quality, as follows:

To 100 grammes of ordinary non-sensitive collodion he adds 50 centigrammes of dry and finely pulverized perchlorid of iron, having no acid reaction; he boils it for a quarter of an hour, and adds four drops of tincture of iodine and filters the mixture. The glass being perfectly cleaned, he pours on the collodion, waits a moment to allow the coating to acquire a certain solidity—then plunges it in a bath of nitrate of silver, again in distilled water, and finally is dried, protected from the dust. The image is revealed as usual by pyrogallic acid.

This collodion is more sensitive than that prepared by using the protochlorids, but is much less so than the moist collodions.

Artificial Alcohol.*

In my last communication I neglected to speak of the production of alcohol by means of water and illuminating gas. M. Berthelot has reached this important result through a species of contact between C_4H_4 dissolved in fuming sulphuric acid and water contained in the acid. This important discovery has been the subject of a Report to the Academy of Sciences by M. Thènard. In this Report (a very flattering one to the young chemist) the venerable Dean of French chemists points out several other attempts of M. Berthelot and among them that of converting grape sugar into cane sugar. In spite of certain difficulties, we may still believe this a possible result. Nevertheless M. Biot doubts the possibility of this change, because it requires that the intimate molecular structure of the substance should be changed, a change to which we have no analogy in the transformations hitherto made known. This difficulty however does not appear to MM. Thénard and Dumas as insurmountable; since in treating cane sugar, with an acid, its molecular constitution is changed so that its rotatory power over the polarized ray is reversed from right to left, why then should it be impossible to convert left-handed rotation to right-handed?

*American Journal of Science.

Micro-chemical Researches on the Digestion of Starch and Amylaceous Foods.

BY PHILIP BURNARD AYRES, M.D. LONDON.*

After some general historical remarks on the methods hitherto employed in the investigation of the complicated phænomena of the process of digestion, the comparatively small results obtained by chemical analysis of the contents of the stomach, intestinal canal, and of the evacuations, by Tiedemann and Gmelin, Berzelius, and others, the author proceeded to demonstrate the necessity of a minute examination of the contents of the alimentary canal by the microscope, and such chemical tests as we possess for the determination of the changes of such articles of food as exhibit definite structure.

In order that we may ultimately arrive at a complete exposition of the phænomena of digestion, he is of opinion that it will be necessary to examine,—first, the structure of particular kinds of food, then the changes produced in them by cooking, and lastly to trace the changes they undergo at short intervals, through the alimentary canal from the stomach to the rectum. The results of a series of researches of this character on the changes in starch, and starch-containing foods, are presented in this memoir.

The method adopted for the examination of the changes in starch and starch-foods was as follows:—An animal was kept fasting twenty-four hours, and afterwards confined to a diet consisting of the starch or amylaceous food, with water, for five or six days, until the debris of all other kinds of food previously taken were cleared from the alimentary canal. At a determinate time, after a meal, the animal was killed, the abdomen laid open as quickly as possible, and ligatures placed at short intervals on the intestinal canal, from the pylorus to the rectum. The contents of the stomach and each portion of the intestinal canal included between the ligatures were then carefully examined. This mode of examination sufficed to determine the changes which occur in the food during normal digestion; but other questions as to the particular secretion or secretions by which the changes observed were effected.

The fluids poured into the alimentary canal are five in number,—the saliva, gastric juice, bile, pancreatic juice, and finally, the intestinal mucus.

The influence of the saliva is easily determined, by chewing the particular food subjected to experiment, and keeping the mixture at about 98° Fahr. The combined action of the saliva and gastric juice is seen in the contents of the stomach. To determine the action of the bile, the common bile-duct was tied, and to ascertain the action of the intestinal mucus, it was necessary to ligature the bile and pancreatic ducts. If the digestion of the substance is not effected in the stomach, it is evident that it cannot be attributed to the saliva or gastric juice; if the digestion is still effected in the intestinal canal after ligature of the bile-duct, it cannot be attributed to the action of the saliva, gastric juice or bile; if it still go on after ligature of the bile and pancreatic ducts, the digestive power must of necessity be referred to the action of the intestinal mucus, provided no change has previously taken place in the stomach; but if the food passes unchanged after cutting off the supply of bile and pancreatic juice, but proceeds after ligature of the bile-duct alone, the act of digestion must be referred to the pancreatic juice.

The author first briefly describes the structure of the starches and starch-containing vegetables employed in his experiments; then the changes produced by cooking, and finally enters on a minute description of the changes observed in the experiments he performed on normal digestion, and after cutting off the supply of bile and pancreatic juice.

The correct appreciation of the structure of the starch-granule is of considerable importance in relation to these investigations, and the author believes that he has been able to afford a satisfactory solution of these vexed questions. The changes observed during the digestion of starch favour the original opinion of Leeuwenhoeck, that the starch-granule consists essentially of an investing membrane or cell-wall, enclosing an amorphous matter, the true starch, which strikes an intense blue colour with iodine; and these changes also support the opinion of Professor Quckett, that the concentric circles seen on the starch-granules of many plants are simple foldings of the investing membrane, leaving it still doubtful, however, whether these concentric circles are not in the starches of some plants composed of linear series of dotted elevations or depressions of the investing membrane.

* The London, Edin. and Dub. Phil. Mag.

By these experiments it was determined that the concentric circles remain after the whole of the starch matter, colourable by iodine, was removed, and that even then the characteristic cross and colours were still seen when the granules were viewed by polarized light, although more feebly than before; this result being probably due to the lessened power of refracting light, after the removal of the starch matter.

After describing the structure of the wheat-grain and flour, the changes occurring in the wheat-starch during the manufacture of bread are given in detail; but the most interesting of the changes produced by cooking are those seen in the boiled or roasted potato and in the boiled pea.

In each of these the act of cooking effects two purposes:—it causes great enlargement and physical change of the starch-granules, and dissolves the intimate adhesion of the starch-cells, which afterwards appear as ovoid or globular, slightly adherent bodies distended by the swollen starch-granules, the out-lines of which are indicated by more or less irregular gyrate lines, produced by the mutual compression of the starch-granules within an inelastic cell-membrane.

The starch-granules of the pea possess a much thicker investing membrane than those of the potato, which causes their outlines to remain much more distinct after the removal of the true starch substance during the process of digestion. The other structures seen in the pea are carefully described; the most curious among them being the cells composing the external layer of the testa, which bear so strong a resemblance to columnar epithelium of the intestine, that they might be mistaken for the latter by an inattentive observer.

The substances submitted to experiment were,—1, boiled wheat-starch; 2, wheaten bread; 3, uncooked tous les mois; 4, boiled tous les mois; 5, boiled potato; 6, uncooked peas; 7, boiled peas; 8, boiled peas after ligature of the bile-duct; 9, boiled potatoes after ligature of the bile and pancreatic ducts. Several subsidiary experiments were made to determine the action of the intestinal mucus, the saliva, and the substance of the pancreas, on starch.

The conclusions at which the author arrives from the experiments are,—

1. That the starch-granule is composed of two parts, chemically and histologically distinct,—a cell-membrane and homogeneous contents. The markings seen on many varieties of starch are referred to folds or markings of the investing membrane.

2. No perceptible change occurs in the starch, whether raw or cooked, during its sojourn in the stomach of quadrupeds or the ventriculus succenturiatus and gizzard of birds; all the granules preserve their perfect reaction with iodine and their pristine appearance.

3. The conversion of boiled starch into dextrine and glucose is chiefly effected in the first few inches of the small intestine, but it continues to take place in a less degree throughout the entire intestinal canal.

4. In the digestion of boiled wheat or other starch, or of wheaten bread, the bulk of the mass rapidly diminishes in its passage through the small and large intestines, so that it ultimately yields only a small quantity of fæcal matter. After being deprived of their contents, the membranes of the granules shrink and shrivel up into a minute granular matter, which constitutes the chief bulk of the fæcal evacuations after an exclusive diet of starch food.

5. The digestion of raw starch food (peas) in the pigeon or other granivorous birds goes on much more slowly, and progresses pretty equally throughout the entire intestinal canal. The starch-granules, whether free or included in cells, become intersected by radiating or irregular lines or fissures, more or less opaque or granular; they also gradually lose their characteristic reaction with iodine; and this important change, commencing at the surface, progresses towards the centre, until the whole of the starch matter is removed, leaving the starch membranes often apparently whole, retaining their characteristic markings. The fissured and granular condition of the starch-granules is not due to their trituration in the gizzard, but to the action of the intestinal fluids, since it was often seen in granules enclosed in and protected by perfect starch-cells. In the digestion of raw starch food, a considerable quantity always escapes change, for many starch-cells and granules in the fæces perfectly retain the characteristic reaction with iodine.

6. As the starch remains unchanged in the stomach, its conversion into glucose cannot be attributed to the saliva or gastric juice, unless we suppose these fluids to remain inactive in the stomach, and suddenly to regain their activity in the first part of the small intestine. The author found that the saliva was capable of effecting the conversion of starch into glucose, but that the mixture of saliva and gastric juice in the stomach did not possess that property even after being rendered alkaline by carbonate of soda. It is probable that the converting power of the saliva, as it flows from the mouth, depends not on the true saliva, but on the buccal mucus; for Magendie found that saliva taken from the parotid duct was wholly inactive, while the mixed saliva from the mouth effected the conversion with great facility. Unless, then, the sublingual and submaxillary glands secrete a different fluid from the parotids, it is evident that the activity of the saliva must be attributed to the buccal mucus.

7. The difference between the digestion of boiled and raw starch in dogs is seen in the experiments on the digestion of boiled wheat-starch, boiled tous les mois, and bread. In all these, some starch-granules escape the action of heat and water, and remain in nearly their pristine condition. These uncooked starch-granules undergo slow and imperfect changes, being fissured, broken, and more or less altered, but in general retaining their characteristic reaction with iodine.

8. The conversion of starch into glucose is not effected by the bile, since after ligature of the common bile-duct, the changes occur to as great an extent as when the bile passes freely into the intestinal canal.

9. It is not due to the pancreatic juice, inasmuch as after ligature of the bile and pancreatic ducts in the same animal, the digestion of starch is still effected.

10. The only remaining secretion is the intestinal mucus, which is especially abundant at the upper part of the intestinal canal: and a further proof is afforded of the activity of the intestinal mucus taken from the upper part of the duodenum above the entrance of the pancreatic duct after ligature of this duct and the common bile-duct, by its capability of converting a large quantity of fresh boiled starch into glucose out of the body.

11. In the cooking of starch-containing vegetables, such as potatoes and peas, the adhesion of the starch-cells is dissolved or weakened, so as to render them easily separable and amenable to the action of the intestinal fluids. At the same time the starch-granules undergo a large increase in bulk, distend the cells, and by their mutual compression, their outlines present the appearance of gyrate lines beneath the cell-wall. The cells seldom burst so as to emit their contents, or present any appreciable opening through which the intestinal fluids can directly penetrate. The author cannot positively affirm so much of the starch-membranes, because these are so extremely delicate that fissures might be invisible, but he believes that in a great number the membranes remain entire.

12. If this be the case, the conversion of starch matter into glucose must be effected by the permeation or endosmose of the intestinal fluids through the invisible pores of two membranes, in the digestion of the pea, the potato, and other similar foods, and the glucose must escape through the same membranes by exosmose.

13. Before the conversion of starch into glucose, the amylaceous matter contained in the starch is more dense than the intestinal mucus in immediate contact with the cells, and an inward current or endosmose is established; but after that conversion, the syrupy fluid is less dense than the mucus, and then an outward current or exosmose occurs, by which the glucose escapes from the cells into the intestine and is absorbed. If this be the case, as the details of the experiments tend strongly to prove, a new and important function is assigned to the intestinal mucus.

14. In normal digestion, chyme escapes very slowly from the stomach into the duodenum, in small quantities, as it is detached from the alimentary mass by the muscular movements of the stomach, and this gradual propulsion often occupies several hours after a meal. This slow propulsion is evidently intended to expose the comminuted food fully to the action of the intestinal juices, and produce an intimate mixture with them. The comparatively empty condition of the upper part of the small intestine, even during active digestion, is thus fully explained.

15. If the food be too finely divided or incapable of a second solidification in the stomach, it passes too rapidly into the first part of the small intestine, is insufficiently mixed with the intestinal fluids, and a considerable part escapes digestion. On the other hand, if it enters the small intestine in masses incapable of reduction by the muscular action of the parts or solution in the fluid, fit traverses the intestinal canal unchanged, except at the surface, which is then alone exposed to the action of the intestinal fluids.

16. It is not necessary for the conversion of starch into glucose that the fluids in the duodenum or other parts of the intestinal canal should be alkaline, or even neutral, for in several of the experiments the contents of every part of the alimentary canal had an acid reaction.

17. The greater part of the intestinal mucus is not excrementitious, for little, if any, mucus is perceptible in the fæces in normal digestion, except at their surface, whereas the greater proportion of the contents

of the small intestine consists of mucus. A considerable quantity of mucus is seen in the cæcum, but it rapidly diminishes in the colon, and is scarcely detectible in the fæces, except that on the surface, which is probably derived from the mucous membrane of the rectum. The author raises the question, whether one of the chief functions of the cæcum is not to effect the conversion of the intestinal mucous into some other substance capable of re-entering the blood, and performing some ulterior purpose in the animal economy.

18. In normal digestion, the separation of the epithelium of the mucous membrane of the intestine is the exception instead of the rule, as stated by some physiologists. The author questions the theory of the detachment of the epithelium of the villi in each act of absorption, on the grounds that the presence of detached epithelium was unfrequent in the whole course of his experiments; that epithelium is readily detached by manipulation; that the continual reproduction of such a vast amount of cell-tissue must necessarily be accompanied by a vast expenditure of vital force; and finally, that it is not necessary, because fluids readily penetrate epithelial membranes.

19. The passage of a given food through the whole length of the intestinal canal may occupy a comparatively short time, especially when the animal is fasting. In one experiment, where a pigeon refused food until the fæces contained no visible debris of previous food, starch-granules were detected in the fæces within two hours after a meal, and this although the intestine of this animal is extremely narrow and about a yard in length.

20. A remarkable circumstance in the digestion of starch or starch foods is the constant presence of myriads of Vibriones in the lower part of the intestinal canal. They are generally first observed in the lower part of the small intestine, as minute brilliant points, just visible with a power of 600 diameters, in active movement. They increase in numbers towards the cæcum, in which a large number of fully-developed vibriones are constantly seen. These minute organisms increase in size and length in the colon and rectum, and their fissiparous mode of propagation, first described by the author in the 'Quarterly Journal of Microscopical Science,' may be distinctly traced by examining the contents of these portions of the intestine.

The Tempering of Steel.

In the discussion on Mr. Sanderson's paper, "On the Manufacture of Steel," an inquiry was made as to the kind of Steel suitable for particular articles, and how its quality might be tested. This gave rise to the remark that the tempering of steel depended on the skill and experience of the workman. Mr. Harry Scrivenor, of Liverpool, has, however, obtained from a clever workman the following memoranda on the subject:—

"I received your letter inquiring what steel was best for different kinds of manufactures. I should say cast-steel, if it can be applied; double shear for hatchets, or any kind of edge tool that cannot be well made of cast-steel. The temper to be as follows:—

"1st. For boring cylinders, turning rolls, or any large cast iron, let it be as hard as water will make it, minding not to heat it more than a cherry red.

	Degrees. Fahr.
2nd. Tools for turning wrought iron, pale straw colour	430
3rd. Small tools for ditto, shade of darker yellow	450
4th. Tools for wood, a shade darker	470
5th. Tools for screw taps, &c, still darker straw colour	490
6th. For hatchets, chipping chisels, brown yellow	500
7th. For small rimers, &c., yellow, slightly tinged with purple	520
8th. For shears, light purple	530
9th. For springs, swords, &c., dark purple	550
10th. For fine saws, daggers, &c., dark blue	570
11th. For hand and pit saws &c., pale blue	590

"The temper greatly depends on the quantity of carbon that is in the steel—this the practical man soon finds out, and he tempers or draws down his tool accordingly."—*Jour. Soc. Arts.*

Oxygen in the Nascent state—Ozone.

For some time past, observations have been made in Europe on atmospheric ozone. Owing to the persevering efforts of MM. Wolf of Berne, D. Bœckel of Strasburg, and Dr. Simonin of Nancy, some general facts of the highest interest have been reached by the use of Schönbein's test (*i. e.* paper made sensitive by starch and iodid of potassium). According to those observations there exists an intimate relation between the quantity of ozone in the air and certain epidemic diseases such as cholera, grippe, intermittent fever, &c. They think they have established that the appearance of the grippe coincides with the presence in the air, of an excess of ozone: that on the contrary the invasion of cholera is accompanied by almost complete absence of ozone in the air; this is at least true for the places above named.

It is well known that ozone is regarded as an isomeric or allotropic condition of oxygen. MM. Becquerel and Frèmy have called it electrized oxygen and have prepared it, by submitting pure oxygen to the electrical current.

The following is a new mode of preparing it in abundance (or at least a *similar* body) capable of oxydizing silver, of decomposing iodid of potassium, of burning ammonia, of disengaging chlorine from hydrochloric acid, and of forming water with hydrogen. This simple process consists in treating peroxyd of barium (BaO_2) with monohydrated sulphuric acid at a temperature below 70° C. The oxygen disengaged in this process possesses the properties named above, and it has the characteristic odor which is known as the Lobster odor. M. Houzeau assistant to M. Boussingault, is the author of this process which he discovered during a series of researches on the preparation of oxygen from the peroxyd of barium by heat.—*Cor. of M. Nickles.—Sill. Journal.*

Chinese Method of Scenting Tea.

A few weeks ago I sent you an account of the Chinese method of dyeing teas with Prussian blue and gypsum, to suit our depraved tastes in England and America. I shall now endeavour to describe a much more agreeable and rational manufacture—namely, that of scenting teas. That it is so in the eyes of the Chinese, may be gathered from the fact, that while they *dye* their teas not to drink, but only to sell, they consume and appreciate highly these scented teas. The following account of this interesting process is copied from my journal:—

"I have been making inquiries for some time past about the curious process of scenting teas for the foreign markets; but the answers I received to my questions were so unsatisfactory that I gave up all hopes of understanding the business until I had an opportunity of seeing and judging for myself. During a late visit to Canton I was informed the process might be seen in full operation in a tea factory on the Island of Honan. Messrs. Wilkinshaw and Thorburn, two gentlemen well acquainted with the various kinds of teas sent annually to Europe and America, consented to accompany me to this factory, and we took with us the Chinese merchant to whom the place belonged. I was thus placed in a most favourable position for obtaining a correct knowledge of this curious subject. When we entered the tea factory a strange scene was presented to our view. The place was crowded with women and children, all busily engaged in picking the stalks and yellow or brown leaves out of the black tea. For this labour each was paid at the rate of six cash a catty, and earned on an average sixty cash a day,—a sum equal to about threepence of our money. The scene altogether was not unlike that in the great Government Cigar Manufactory at Manilla. Men were employed giving out the tea in its rough state, and in receiving it again when picked. With each portion of tea a wooden ticket was also given, which ticket had to be returned along with the tea. In the northern tea countries the leaves are carefully weighed when they are given out and when they are brought back, in order to check peculation, which is not unfrequent. I did not observe this precaution taken at Canton. Besides the men who were thus employed, there were many others busily at work, passing the tea through various sized sieves, in order to get out the caper, and to separate the various kinds. This was also partly done by a winnowing machine, similar in construction to that used by our farmers in England. Having taken a passing glance at all these objects on entering the building I next directed my attention to the scenting process, which had been the main object of my visit,—and which I shall now endeavour to describe.

"In a corner of the building there lay a large heap of orange flowers, which filled the air with the most delicious perfume. A man was engaged in sifting them, to get out the stamens and other smaller portions of the flower. This process was necessary, in order that the flowers might be readily sifted out of the tea after the scenting had been accomplished. The orange flowers being fully expanded, the large

petals were easily separated from the stamens and smaller ones. In 100 parts 70 per cent. were used and 30 thrown away. When the orange is used, its flowers must be fully expanded, in order to bring out the scent; but flowers of jasmine may be used in the bud, as they will expand and emit their fragrance during the time they are mixed with the tea. When the flowers had been sifted over in the manner described they were ready for use. In the meantime the tea to be scented had been carefully manipulated, and appeared perfectly dried and finished. At this stage of the process it is worthy of observing, that while the tea was perfectly *dry* the orange flowers were *just as they had been gathered from the trees.* Large quantities of the tea were now mixed up with the flowers, in the proportion of 40℔. of flowers to 100℔. of tea. This *dry* tea and the *undried* flowers were allowed to lie mixed together for the space of twenty-four hours. At the end of this time the flowers were sifted out of the tea, and by the repeated sifting and winnowing processes which the tea had afterwards to undergo they were nearly all got rid of. Sometimes a few stray ones are left in the tea, and may be detected even after it arrives in England. A small portion of tea adheres to the moist flowers when they are sifted out, and this is generally given away to the poor, who pick it out with the hand.

"The flowers, at this part of the process, had impregnated the tea leaves with a large portion of their peculiar odours, but they had also left behind them a certain portion of moisture which it was necessary to expel. This was done by placing the tea once more over slow charcoal fires in baskets and sieves prepared for the purpose of drying. The scent communicated by the flowers is very slight for some time, but like the fragrance peculiar to the tea leaf itself, comes out after being packed for a week or two. Sometimes this scenting process is repeated when the odour is not considered sufficiently strong; and the head man in the factory informed me he sometimes scented twice with orange flowers, and once with the "Mo-le" (*Jasminum Sambac*).

"The flowers of various plants are used in scenting by the Chinese, some of which are considered better than others, and some can be had at seasons when others are not procurable. I considered it of some importance to the elucidation of this subject to find out not only the Chinese names of these various plants, but also by examining the plants themselves, to be able to give each the name by which it is known to scientific men in all parts of the world. The following list was prepared with great care, and may be fully relied upon. The numbers prefixed express the relative value of each kind in the eyes of the Chinese, and the asterisks point out those which are mostly used for scenting teas for the foreign markets:—

1. Rose, scented (Tsing moi-qui hwa).
1 or 2. Plum, double (Moi hwa).
2*. Jasminum Sambac (Mo-le-hwa).
2 or 3*. Jasminum paniculatum (Sieu-hing-hwa).
4*. Aglaia odorata (Lan-hwa, or Yu-chu-lan),
5. Olea fragrans (Kwei hwa).
6*. Orange (Chang hwa).
7*, Gardenia florida (Pak-sema hwa).

It has been frequently stated that the Chloranthus is largely used. This appears to be a mistake, originating, no doubt, in the similarity of its Chinese name to that of *Aglaia odorata.* The Chloranthus is called 'Chu-lan;' the Aglaia 'Lan' or 'Yu-chu-lan.'

"The different flowers which I have just named are not all used in the same proportions. Thus, of Orange flowers there are 40 ℔. to 100 ℔. of tea; of Aglaia there are 100 ℔. to 100 ℔.; and of *Jasminum Sambac* there are 50 ℔. to 100 ℔. The flowers of the Sieu-hing (*Jasminum paniculatum*) are generally mixed with those of the Mo-le (*Jasminum Sambac*) in the proportion of 10 ℔. of the former to 30 ℔. of the latter, and the 40 ℔. thus produced are sufficient for 100 ℔. of tea. The 'Qui-hwa' (*Olea fragrans*) is used chiefly in the northern districts as a scent for a rare and expensive kind of Hyson Pekoe,—a tea which forms a most delicious and refreshing beverage when taken *a la Chinoise*, without sugar and milk. The quantity of flowers used seemed to me to be very large; and I made particular inquiries as to whether the teas that are scented were mixed up with large quantities of unscented kinds. The Chinese unhesitatingly affirmed that such was not the case, but notwithstanding their assertions, I confess I have some doubt on this point.

"The length of time which teas thus scented retain the scent is remarkable. It varies, however, with the different sorts. Thus the *Olea fragrance* tea will only keep well for one year; at the end of two years it has either become scentless, or has a peculiar oily odour which is disagreeable. Teas scented with Orange blossoms and with those of the Mo-le will keep well for two or three years, and the Sieu-hing kinds for three or four years. The Aglaia retains the scent longer than any, and is said to preserve well for five or six years. The tea scented with the Sieu-hing is said to be most esteemed by foreigners, although it is put down as second or third rate by the Chinese.

"Scented teas for the foreign markets are nearly all made in Canton, and are known to merchants by the names of 'Scented Orange Pekoe,' and 'Scented Caper.' They are grown in and near a place called Tai-shan, in the Canton Province Mr. Walkinshaw informs me that other descriptions of tea, both black and green, have been scented for the English market but have been found unsuitable. True 'caper' is to black tea what the kinds called 'imperial' and 'gunpowder' are to green: it assumes a round, shot-looking form, during the process of manipulation, and it is easily separated from the other leaves by sifting or by the winnowing machine. It is a common error to suppose that 'imperial' or 'gunpowder' amongst green teas, or 'caper' amongst black ones, is prepared by rolling each leaf singly by the hand. Such a method of manipulation would make them much more expensive than they are. One gathering of tea is said to yield 70 per cent. of orange pekoe, 25 of souchong, and 5 of caper. The quantity of true caper would therefore appear to be very small; but there are many ways of increasing the quantity by peculiar modes of manipulation.

"In a large factory, such as this at Canton, there is, of course, a considerable quantity of dust and refuse tea remaining after the orange pekoe, caper, and souchong have been sifted out of it. This is sold in the country to the natives at a low price, and no doubt is often made up with paste and other ingredients into those *lie teas* which now-a-days find a market in England. Nothing is lost or thrown away in China. The stalks and yellow leaves which have been picked out by women and children are sold in the country; while the flowers which have done their duty in the scenting process are given to the poor, who pick out the few remaining tea leaves which had been left by the sieve or winnowing machine. Some flowers, such as those of the Aglaia for example, after being sifted out from among the tea are dried and used in the manufacture of the fragrant 'joss stick,' so much used in the religious ceremonies of the country.

"It appears from these investigations that many kinds of fragrant flowers besides those used by the Chinese would answer the purpose equally well, and therefore in places like India, where tea is likely to be produced upon an extensive scale, experiments in scenting might be made with any kinds of Jasmines, Daphnes, Aurantiaceous or other fragrant plants indigonous to the country."—R. F.

Consumption of Smoke.

The following synopsis of conclusions arrived at by the General Board of Health (Eng.), with reference to the operations of inventions for the consumption of smoke, has been submitted to Viscount Palmerston by the Board.

1. That the emission of smoke is the effect and may be taken as the proof of imperfect combustion, and is therefore always attended with waste of fuel.

2. That the fuel wasted is not only the visible smoke, which is unburnt carbon, but generally a far larger portion in the form of gas, both common coal gas and that called carbonic oxide, which is only half-burnt carbon, and which therefore has not produced the heat which it would have generated if it had been perfectly consumed.

3. That the chief impediment to the prevention of smoke in manufactories is the insufficient boiler surface in proportion to the steam required; a deficiency which causes waste in two ways; first because much of the heat produced escapes up the chimney uselessly, and next because this deficiency has to be made up by over-firing, whence imperfect combustion and consequent waste of fuel.

4. The employers of furnaces labour under great difficulty as to the best and most economical use of fuel, because ordinary makers of furnaces seem to be guided in their construction by little better than empirical rules, instead of acting upon well established scientific principles or the results of accurate experiments.

5. That notwithstanding this great difficulty many persons have succeeded in entirely preventing the escape of visible smoke, except while first lighting their furnaces, and many others have reduced the time during which smoke is emitted to a small fraction of its former amount.

6. That experience has fully proved that there is no truth in the common allegation, that if smoke be prevented, there must be increased difficulty in getting up and maintaining steam.

7. That successful modes of preventing smoke, if there be proper boiler surface, may be adopted without the infringement of any patent

right, the methods in question not having been patented or the patents having expired.

8. That notwithstanding the great and obvious advantages of perfecting the combustion of fuel, and the certainty that the cost of doing so will be amply repaid by the saving effected, such is the indisposition of practical men to depart from the beaten track, that nothing but the force of law is likely to ensure the care and attention necessary to protect the public from a grievous nuisance, the manufacturers themselves from heavy unnecessary expense, and the national resources from grievous waste of fuel to the amount of millions a-year.

9. That though the absolute and immediate prohibition of smoke could not be enforced without compelling most of the owners of furnaces to incur very heavy expenses, its reduction to a very small amount may be effected with comparative ease, and with very great benefit both to themselves and others; while it cannot be denied, that any who produce more smoke than others who use fuel for the same purposes, do produce more than is practically necessary.

10. That the enforcement of smoke regulations can be most easily and quickly effected by the appointment of constables to keep a regular and constant watch upon all chimneys liable to emit much smoke; and that the prevention of smoke will be more quickly and certainly effected by constant supervision and immediate information of any breach of the regulations, than by heavy penalties irregularly imposed.

11. That great facility in the prevention of smoke would be afforded by the publication of the specifications and descriptions of patented and other inventions for the prevention of smoke, by which those interested could be informed what they could and could not do in this matter, without infringing upon any patent right.

12. That great facility would also be afforded by the appointment of officers specially qualified, and *not connected with any patentee, or manufacturer of boilers or furnaces*, to superintend the police officers employed to suppress the nuisance of smoke, and to advise owners of furnaces how best to comply with the provisions of the law, and to report upon cases of its infringement.

Pre-historic History of Scotland.*

Geology, properly speaking, is a branch of history which reveals the current of past events, not by the aid of documents, or the interpretation of traditions, but by the observation of skeletons and remains of vegetation. Consequently, the greater, and by far the most striking, part of geological history, relates to what took place before man appeared upon the scene. There is, however, a long interval between the occupation of the world by man and the commencement of history proper. Take, for example, the case in this respect of our own island. From the time when Pharaoh was contemplating the erection of the pyramids, or Cecrops founding Athens, or Joshua besieging Jericho; from the time, in fact, when mankind began to disperse over the world to the landing of Julius Cæsar at Deal, what does history tell us of the habits and customs of the early inhabitants of Britain—of our savage ancestors? Nothing. There may, however, be said to be a geological formation lying over the newest tertiary, deposited ere history began her records, and containing the fossils of men who have dwelt in it, but of men of we know not what tribe or nation, and of whom history has never given, and never can give an account; yet the researches recently made geologically into the anthropological formation, if we may so term it, have at least thrown some light into that which was utter darkness.

Antiquarianism, notwithstanding its having been a very favourite pursuit with many, has never until quite recently attempted to solve this problem. Indeed, to the antiquary, the unknown savage, of whom history told no tale, was an object of contempt. He must have a Danish axe in his coffin, or a Roman toga for a shroud, before antiquarian sympathy can be roused. Antiquarianism was thought a branch, and a subordinate branch of history, and not a science of itself; and still less a geologically connecting link between geology and history, destined in some sort to fill up the blank and dreary space that extended between the two. Of late, however, this has been amended. The Scandinavian antiquaries have geologically deduced some important facts regarding the pre-historic period; and Dr. Wilson has followed up the inquiry, with regard to Scotland, in a manner worthy of all praise. His work upon the pre-historic antiquities of Scotland contains an immense mass of facts, with a due proportion of rational deduction. Taking it for a guide, we may conclude pretty nearly as follows:—

Scotland (and unquestionably England and Ireland also) has, without doubt, been inhabited for a very long time; probably for many centuries before the Roman invasion, and the beginning of historical records. From a diligent examination of ancient tombs and their contents, and of other monuments and remains, it is made clear that three different subformations, if we may so call them, may be traced in Scotland, extending from the colonization of the land to the commencement of history. The first may be called the Stone formation; because the men that lived during it, and whose remains are found in it, were acquainted with no weapons, implements, or utensils, save such as were constructed out of stone. The second may be denominated the Bronze formation; as during its prevalence, we have evidence that the inhabitants were acquainted with tin and copper, and constructed weapons, ornaments, &c., of bronze—a compound of these two metals. The third is the Iron formation; so called, because those who figured in it knew and employed iron—and with the close of this formation begins the dawn of history.

It is curious to think that, during the deposition of these prehistoric formations, Scotland was a forest, and that where now is mile after mile of moss and blackness, there flourished oaks; and that among these lived numerous wolves, wild boars, and savage bulls. To secure himself from these enemies, even if he had none such in his brother man, the aboriginal Caledonian required a dwelling; and even in the stone period, he contrived to have some such protection. The dwellings of the men of this state were like those of the badgers, and indeed like those of certain natives of Siberia at this day—underground. Dr. Wilson has collected curious instances of such. They are, he tells us, most uniformly found in groups—a striking instance of the propensity of mankind to sympathize with each other. The rudest of them are merely excavations in the ground, and do not appear to have been longer than eight feet, and not even stones were employed to make them more substantial.

Stones, however, were often employed in constructing them. "The Aberdeenshire caverns," writes Wilson, "are constructed of huge masses of granite, frequently above six feet in length; and, though by no means uniform either in internal shape or dimensions, a general style of construction prevails throughout the whole. Some of them have been found upwards of thirty feet long, and from eight to nine feet wide. The walls are made to converge towards the top, and the whole is roofed in by means of the primitive substitute for the arch which characterizes the Cyclopean structures of infant Greece, and the vast temples and palaces of Athens and Yucatan. The huge stones overlay each other in succession, until the intervening space is sufficiently reduced to admit of the vault being completed by a single block extending from side to side. They have, not unfrequently, smaller chambers attached to them, generally approached by passages not above three feet in height; and it affords a curious evidence of the want of efficient tools in the builders of those subterranean structures, that when these side apartments are only separated from the main chamber by the thickness of the wall, the stones, though placed flush with the walls of the latter, project irregularly into the small cells, giving them a singularly unshapely and ragged appearance."

These subterranean dwellings are very common in Scotland, and there is scarcely a moor, perhaps, in which, if sought for, they may not be found. The remains of foxes and animal bones are found in them, together with weapons, personal ornaments, and implements, all made of stone. Upon one or two occasions, the weapons, or part of the stone weapon that had inflicted death, has been found in the tomb containing the skeleton of the murdered man. It seems almost strange to find, in so rude and barbarous an age, personal ornaments; but such abound. Among the most remarkable of these, are two stone imitation horse-collars, which were found near Glenroy, and which are elaborately carved. Generally speaking, however, these ornaments are not well finished, and very often are only necklaces made of oyster and cockle shells strung together.

The skeletons found in the sepulchres belonging to the stone period, tell us that the Aborigines were a short and poorly developed race, particularly in their hands and feet. Their crania are very remarkable. The jaws and zygomata and bones of the face are large, while the skull cap is small; in fact, they present just such a conformation as we should expect to find among savage hunters who had no opportunity of intellectual exercise. We infer from the examination of these crania, that their possessors belong to Prichard's division of the human

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* Pre-historic History of Scotland, by Daniel Wilson, L.L.D., University College, Toronto. Abstract of an article in the Westminster Review, July 1855.

race, named by him Allophylians. Dr. Prichard maintains that the religion of these Allophylian tribes was Fetishism, and mainly consisted in the employment of spells and incantations, without any hope or fear of a future state in which there should be retributive justice.

It is a curious fact on a small scale, that the teeth in these Allophylian crania are uniformly found perfect and unchanged. Animals that live nearly entirely upon flesh may to this day generally be observed to preserve their teeth in like manner to old age. But the cause of the exemption of these aboriginals from toothache may have been partly the shortness of their lives, and partly the prevalence of hunger and absence of dyspepsia.

To the stone period succeeded that of the Bronze. This country has from time immemorial been famous for her mines of copper and of tin. There can be no doubt but that the Tin Islands of Herodotus referred to Cornwall and its adjacent islets, and that the Phœnicians visited them for the sake of their important metals. We can even trace indications of these visits in the earliest British coins, which have a Phœnician construction. Implements, weapons, and utensils of bronze were probably first obtained from the foreign visitors, but ultimately our forefathers would learn to construct them for themselves; and in the remains of this bronze formation, in which, however, no iron is to be found, we perceive evidences of an extended civilization, a greater amount of comfort, the possession even of luxuries, and of an increased development of intellectual attainments.

Thus the men of these islands no longer dwelt in underground holes, but erected structures from the spoils of the adjacent forest. The cleared spaces would give opportunity for the hunter to practise the art of the husbandman, and his new alloy would afford him the means of tilling the soil. The weapons used in war became, if not more deadly than the old stone ones of sling-balls, more elegant, and we perceive weapons of defence as well as offence. Of this latter kind, the more common remains are those of shields, uniformly round, and with bosses in the centre. The domestic utensils formed of bronze, or rather the remains of them, show considerable art and refinement; and to this class, along with those of bronze, we must now associate some of pottery. Personal ornaments too assume a degree of elegance that strongly contrasts with the oyster necklaces of the rude inhabitants of the stone period, and we learn from such of these as we find lying in the ground of the bronze formation, that those who dwelt here during its deposition were also acquainted with gold and silver. Perhaps the greatest indication of all, of the improved civilization of the men of this formation, is the fact of inscriptions occurring on their sepulchral monuments. The men of the stone time were burned without any indication that their course was not altogether run, but those of the bronze period were even after dead still represented as linked up with human aspirations and futurity. Last of all, we trace in the remains of this period, preponderance of female ornaments, indicative of women having attained a higher social position.

From this we come to a new formation, containing relics of man along with worked iron. We have not space to dwell upon its characteristics;—the many uses to which that metal was put,—the signs of the subjugation of the horse,—the evidence of the existence of strongholds—of the greater cranial development of the skulls, or of the appearance of the true Celtic head. We are able to trace the dying away of this formation, and of its passing into the traditional historics, the times of Macbeth and his wife Gruach; St. Patrick, St. Keernan, and the Northmen. Then we come to the days of history.

Even in these (geologically speaking) recent times, the transition of land to sea, and of sea to land, has in Scotland been considerable. For example, ten yards under the surface of the present canal of Falkirk, and far removed from any navigable stream, a canoe was found. Nay, in the same district, when constructing the Union Canal, the skeleton of an elephant was discovered, pointing perhaps to land communication long since destroyed. At the distance of a mile from the Frith of Forth, the bones of a whale were discovered, with a bone harpoon in them. Still more recently, another whale's skeleton with another harpoon was found seven miles farther inland, on what is now the Blair Drummond estate. Analogous remains have been discovered about the valley of the Clyde, all of which go to prove that it too was once the bed of an extinct estuary. Other relics in other localities tell the same tale for their districts, and show us that the geographical appearances of Scotland have been greatly changed, and that former seas have become dry land, as also former lands have probably become sea-beds.

Permanent Impressions of Flowers on Glass.*

Mr. Robert Smith of Blackford, who has often contributed to our pages, has contrived a very ingenious and effective plan of ornamenting glass, by producing thereon, permanent impressions of flowers, leaves of plants, and other objects. In this process of ornamentation, the operator goes to work by first preparing the objects to be reproduced on the glass surface with a solution of gum. The details of the figure are thus attached to the glass, in the positions required by the device. The entire face of the glass thus treated, is then covered over with a composition of oil, tallow, and wax, in a warm state. When this composition coat becomes solid, the objects are removed from the glass, which is now submitted to the action of fluorine gas; or liquid fluorine may be poured upon the glass; or further, the plate may be treated with fluor spar and sulphuric acid. This is the ordinary treatment involved in glass etching—the peculiarity of Mr. Smith's process being the mode in which the design or the line of action of the acid is produced. The fluorine corrodes the glass only at the parts where the flowers or pattern objects have been placed, and hence the forms of the objects, however elaborate or delicate, are faithfully reproduced from the models supplied by nature herself. The ornamental designs produced in this way are extremely beautiful, contrasting as strongly with the result of ordinary staining, as does a good daguerreotype picture, or nature painting, with a mechanically produced engraving: the figuring accomplished in this way may be coloured as fancy suggests, by the common process of baking or "burning-in" in a furnace. This is another of those processes, by which we are now compelling nature to reproduce for us her choicest devices in a more enduring form.

Steam as an Industrial Agent.*

Mr. William Fairbairn, whose great services in developing mechanical science can never be overlooked or forgotten in any quarter of the world where mechanical talent possesses rank at all, has just given one more proof of his attention to the exigencies of the times, by delivering two elaborate lectures at the Manchester Mechanics' Institution, on "Steam, its Properties and Application to the Useful and Industrial Arts." In that great centre of steam power, such a subject, commented upon by such an authority, and coming, too, in the wake of the movement there making to secure a better system of steam superintendence, was certain of meeting with more than ordinary attention; and we are glad to find that the lecturer's efforts were duly appreciated by the large audiences assembled to meet him. In that portion of his discourse which related to boilers, he stated that the cylindrical or spherical was the most eligible and the strongest form in which iron plates would resist internal pressure. The deduction for loss of strength, on account of riveted joints and the position of the plates, was about 30 per cent. for the double riveted joints, and 44 per cent. for the single ones; the strength (calling the plates 100) being in the ratio of 100, 70 and 56. He found that 34,000 lbs. to the square inch was the ultimate strength of boilers having their joints crossed and soundly riveted. Flat surfaces, frequently essential, were not so objectionable with respect to strength as they appeared to be at first sight, but when properly stayed, were the strongest part of the construction. This was proved by the result of experiments made on the occasion of the bursting of a boiler at Longsight. Two thin boxes 22 inches square and 3 inches deep, were constructed. One corresponded in every respect to the sides of the fire-box of the exploded boiler, the stays being in squares, 5 inches asunder, and the side containing 16 squares of 25 inches area. The other contained 25 squares of 16 inches area, the stays being 4 inches asunder. One side of both boxes was a copper plate ½-inch thick; and the other side of both an iron plate three-eighths inch thick. To these the same valve, lever, and weight were attached, and the pumps of an hydraulic press applied. That divided into squares of 25 inches area, swelled ·03-inch with the eighth experiment, at a pressure of 455 lbs. to the square inch. At the nineteenth experiment, with a pressure of 785 lbs. to the square inch, the sides swelled ·08-inch; and at a pressure of 815 lbs. the box burst by the drawing of the head of one of the stays through the copper, which, from its ductility, offered less resistance to pressure in that part where the stay was inserted. The tenth experiment, with the other box of 16 inch areas, resulted in a swelling of ·04-inch, the pressure being 515 lbs. to the square inch. At 965 lbs. the swelling was ·08-inch, and from that point up to 1265 lbs. the bulging was inappreciable. With the forty-seventh experiment, at a pressure of

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* From the London Practical Mech. Journal, April, 1855.

1625 lbs., one of the stays was drawn through the iron plate, after sustaining the pressure upwards of 1½ minutes, the swelling at 1595 lbs. having been ·34-inch. The first series of experiments proved the superior strength of the flat surfaces of a locomotive fire-box, as compared with the top or even the cylindrical part of the boiler. The latter evidenced an enormous resisting power, much greater than could be attained in any other part of the boiler, however good the construction; and they showed that the weakest part of the box was not in the copper but in the iron plates, which gave way by stripping or tearing asunder the threads or screws in part of the iron plate. According to the mathematical theory, the strength of the second plate would have been 1273 lbs.; but it sustained 1625 lbs., showing an excess of one-fourth above that indicated by the law, and that strength decreased in a higher ratio than the increase of space between the stays. The experiments show a close analogy as respects the strengths of the stays when screwed into the plates, whether of copper or iron; and riveting added nearly 14 per cent. to the strength which the simple screw afforded. These experiments were conducted at a temperature not exceeding 50° Fahrenheit. His experiments on the effects of temperature on cast iron, did not indicate much loss of strength up to a temperature of 600°; and he concluded that the resisting stays and plates of locomotive boilers were not seriously affected by the increased temperature to which they were subjected in a regular course of working.

Some Experiments upon Coffee as a Beverage.

BY AUGUSTUS T. DALSON AND CHARLES M. WETHERILL, PH. D., M. D.

There are two great classes of beverages in use among all nations of men, whether the most civilized or the most savage. One of these classes is alcoholic, the other may be called, for brevity, the non-nitrogenized. Physiologists are pretty generally agreed, that the nitrogenized articles of food are especially effective by their union with oxygen in the body in keeping up the supply of animal heat important to life, and that if such food be liquid so as to be more quickly absorbed, it will effect its result more speedily. The South American Indians ferment their maize, reducing it to pulp by mastication; the Pacific Islanders prepare their *arva* from a root in a similar manner; the Tartars, Arabs and Turks ferment and distil the milk of mares and cows, and among the more civilized nations, those of warm climates employ mild wines, while those of cold countries prepare a stronger alcoholic drink by distillation. In general, the colder the climate the stronger is the drink and more deplorable is the consequence of its abuse. Whether this craving for alcohol in some form or other be an instinct implanted in our nature or not, and if so, whether it be not wiser to direct rather than to attempt to eradicate it, are questions which are at present about being investigated experimentally on a large scale in our country, and whatever be the result, are deeply interesting, not only from a moral but from a psychological point of view. The other class of beverages, containing nitrogen, is one, the use of which is as widely spread as the former. Nitrogenized food is supposed effective to replace the substance of the different organs of the body, gradually wasted away by the processes of vitality.

That which is the subject of this article, *coffee*, although in its introduction, violently opposed and subjected to prohibitory laws, is at present regarded as a boon to humanity, and is cultivated to the extent of six hundred millions of pounds weight.

Besides the tannin in the coffee, and which is somewhat altered during the process of roasting, the berry is characterized by two substances; one, nitrogenized, *caffeine*, which is contained in the proportion of about one per cent. (the same exists in nearly a double proportion in tea,) and is not altered by the roasting process, and the other a peculiar volatile oil developed during the roasting, existing in an extremely minute quantity, and to which coffee owes its delicious flavor. Dr. Julius Lehman (*Liebig's Annalen* LXXXVII, 205) has investigated the effects of these two substances upon the system, and has shown that coffee retards the waste of the tissues of the body, and that consequently its use diminishes the amount of food necessary to preserve life. This effect he ascribes to the latter. These two acting to excite to greater activity the nervous and vascular systems, give to the wearied mind a greater elasticity and stimulate it to increased reflection. The increased activity of the heart, (and headache, &c., when taken to excess) are caused by the caffeine, and the increased action of the kidneys, the sudoriferous glands, and the intestines, together with the restlessness and congestion caused by an excess, he ascribes to the volatile oil. These effects were studied by Lehman by analysis of the excretory products of a person in a normal condition, and while under the influence of the above substances, and the conclusion is confirmed by deductions from observations made upon the effect of coffee upon the poorer classes of people whose nourishment is necessarily restricted. Much of the *nutritive* portion of coffee, namely, that contained in the legumine of the berry, is lost by the European method of making coffee, but the caffeine, contains nearly 29 per cent. of nitrogen, and Payen has calculated that a quart of *cafe au lait*, contains six times more nitrogen than an equal measure of flesh broth. Liebig has called attention to the fact that 140 milligrammes of caffeine correspond to 31 of gall in the form of taurine, and that if a decoction of coffee or tea contains only 0·05 centigrammes of caffeine, it must produce an appreciable effect, if this substance conduces to the formation of bile, which seems probable from its beneficial effect in certain diseases and in treatment for poisonings.—*Journal of the Franklin Ins.*

CANADIAN INSTITUTE—ELECTION OF MEMBERS.

Council Meeting, April 25, 1855.

The following gentlemen were provisionally* elected members of the Institute:—

George Morphy	Toronto.
J. G. Ridout	"
W. C. Evans	Montreal.
Rev. J. G. Geddes	Hamilton.

June 19th, 1855.

Sir George Simpson	Lachine, C.E.
James Webster	Guelph.
William Wilson	Simcoe.
James Crawford	Brockville.
W. Kingsford, C.E	Toronto.
W. Hodgins, C.E	Hamilton.
Colonel Baron de Rottenburg	Kingston.

June 27th, 1855.

J. Russell, M.D	Toronto.
A. Jackes, M.D	St. Catherines.
Charles Jones	Toronto.
Alexander Murray	Woodstock.

* During the interval between the Sessions of the Institute, gentlemen desirous of becoming members may be provisionally elected by the Council, when duly proposed, and their election confirmed at the first ordinary meeting of the Institute in the ensuing Session. The formal election of members can only take place at an ordinary or general meeting of the Institute. The first ordinary meeting of the Session of 1855-56 takes place on Saturday, December 1st, 1855.

August 4th, 1855.

Captain Beecher, R.N	London, England.
Hon. Robert Spence	Quebec.
Archibald Carlyle	Orillia.

Donations received since May 1st, 1855.

From the Hon. W. B. Robinson, M.P.P.

Report of the Select Committee on the Geological Survey.

Report on the Dredging of Lake St. Peter, and on the Improvement of the River St. Lawrence, between Montreal and Quebec, with Charts, by Thomas Keefer, Engineer.

Geological Survey of Canada, Report of Progress, years 1852-53.

Preliminary Report of the Secretary to the Executive Committee of Canada, in connection with the World's Exhibition, Paris, 1855.

Second Report of the Standing Committee on Public Accounts.

Statements of Sums expended out of £30,000 for aiding the Settling of vacant Crown Lands in Lower Canada.

Report of the Commissioners of Public Works, 1852 and 1853.

Report on Caughnawaga Canal.

Report on Trade and Navigation, 1854.

Railway Map of Canada, 1853.

The Outlines of Flemish Husbandry.

Miscellaneous Parliamentary Documents.

From the Hon. J. H. Cameron, M.P.P.

Annual Report of the Normal and Model Schools and Common Schools of Upper Canada.

Reports of the Commissioners appointed to inquire into a series of Accidents and Detentions on the Great Western Railway, Nov. 3, 1854.

Report of J. B. Jarvis, Esq., relative to the Survey of the proposed Caughnawaga Canal, and Documents relative to the Survey and Improvement of the Rapids of the River St. Lawrence, by Messrs. Maillefort and Radsloff, Civil Engineers.

From the Societies, through H. Rowsell, Esq.

Quarterly Journal of the Geological Society, May, 1854.
" " " " " August "
" " " " " November "
" " " " " February, 1855.

Journal of the Asiatic Society of Great Britain and Ireland. Vol. XVI., Part I.

Descriptive Catalogue of the Historical Manuscripts in the Arabic and Persian Languages preserved in the Library of the Society.

Essay on the Architecture of the Hindus, by Râm Râz, Native Judge at Bungalore, Corresponding Secretary of the Society; 48 plates.

Address at the Anniversary Meeting of the Royal Geographical Society, 22d May, 1854, by the Right Hon. the Earl of Ellesmere, K.G., D.C.L.

From the Board *of* Agriculture.

Journal and Transactions of the Board of Agriculture of Upper Canada, No. I, Vol. 1, April, 1855; No. II., Vol. I., July, 1855.

From the Regents *of the* University *of the* State *of* New York.

Documents relating to the Colonial History of New York. Vol. V.

Sixteenth Annual Report of the Regents of the University of the State of New York, 1855.

Annual Report of the Trustees of the State Library of the State of New York.

From the Hon. East India Company.

Bombay Magnetical and Meteorological Observations for year 1851.

From Dr. R. Beck, *through* C. Jones, Esq.

Eighth Annual Report of the Regents of the University of the State of New York, on the Condition of the State Cabinet of Natural History and Historical and Antiquarian Collection annexed thereto.

Report of the Alms' House Committee on the subject of a Re-organization of that Institution.

Public Schools in Albany, 1855.

Sixth Annual Report of the Albany Penitentiary, 1855.

From the Society.

Twenty-seventh Annual Report of the Natural History Society of Montreal, 1855.

Prevention of Smoke in Steam Vessels.—An experiment has been tried at Portsmouth, on board the royal steam-tender Elfin, with Mr. Prideaux's furnace valves for the protection of smoke. Not only was the smoke effectually got rid of, and with West Hartley coals, but the steam was kept up in the boilers at full pressure after one furnace fire out of four was extinguished, showing that the advantages conferred by these valves in preventing smoke and reducing the temperature of the engine-room are obtained without any diminution of the steam-generating power of the furnaces. Upon Mr. Prideaux's valve doors being removed and the ordinary doors substituted, the thermometer, which had previously stood at 66 degrees, rose to 96; exemplifying what must certainly be regarded as one of the features of this invention—viz., that during its use the exterior of the fire furnace door always remains cool no matter to what extent the firing may be pushed.

On the Dicynodon Tigriceps, by Prof. Owen.—In this paper Prof. Owen described a new species of extinct bidental reptile (*Dicynodon tigriceps*), transmitted by A. G. Bain, Esq., from South Africa. The skull surpasses in size that of the largest Walrus, and resembles that of the lion or tiger in the great development of the occipital and parietal ridges, the strength of the zygomatic arches, and the expanse of the temporal fossæ,—all indicating the possession of temporal (biting) muscles as largely developed as in the most powerful and ferocious of the carnivorous mammalia. This unique modification of a sauroid skull is associated with the presence of a pair of long, curved, sharp-pointed, canine tusks, descending as in the machairodas and walrus, outside the lower jaw when the mouth is shut, these tusks being developed to the same degree as in the smaller species of Dicynodon (*D. lacerticeps, D. testiduceps*, &c.,) described by the author in a former memoir; and, as in those species, so in the present more gigantic one, no other trace of teeth was discernible, the lower jaw being edentulous, as in the extinct Rhynchosaurus, and the Chelonian reptiles. Most of the extinct reptiles exemplify the law of the prevalence of a more general structure, as compared with the more specialized structures of existing species. The Labyrinthodonts combined sauriod with Batrachian characters; Rhynchosaurus, sauroid with Chelonian characters. The Ichthyosaurus had modifications borrowed from the class of fishes, and the Pterodactyle others borrowed from the type of birds and bats,—in both cases engrafted on an essentially sauroid basis. The Dicynodonts—which were like lizards in their more important cranial character, as, for example, the divided nostrils, the dependent tympanic bone, and the pair of symmetrical suboccipital processes—resembled the crocodiles in the extent of ossification of the occiput, resembles the Tryonyces in the extent of ossification of the palate, and in the form and position of the posterior nostril; and resembled the Chelonia generally in the edentulous, trenchant border of the whole of the alveolar part of the lower jaws and of a great part of that of the upper jaw. But they also superadded to this composite reptilian structure of the skull a pair of long, sharp, descending tusks, and temporal fossæ and ridges, which seem to have been borrowed from the mammalian class.

Citric Acid Contaminated with Copper.—Citric acid being now much used in the preparation of lemonade, its purity becomes a matter of some importance. Incidentally copper has been detected in several samples—an impurity not previously suspected. From a bottle of lemonade 26 centigrammes of metallic copper were extracted, being in the proportion of 9 centigrammes to the kilogramme of acid. Samples of citric acid, before being used in the preparation of any beverage or article of food, should be tested with the yellow prussiate of potash, and rejected if a red tint or precipitate appears.—*Artizan.*

Erratum.—Page 304, line, 47, for "official" read "unofficial."

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—June, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Direct.	Mean Vel'y	Rain in Inch.
1	29·404	29·216	29·284	29·289	59·6	62·9	54·9	59·1	+ 2·2	0·444	0·516	0·401	0·461	·89	·93	·95	·93	S W b S	S E b E	N N W	W 36 N	4·57	0·315
2	·356	·346	·377	·371	50·6	69·1	47·7	54·8	— 2·5	·330	·453	·268	·346	91	65	82	81	N W b N	S S E	N b W	N 27 W	4·39	0·025
3	·418	·448	—	—	54·6	54·6	—	—	—	·374	·283	—	—	90	68	—	—	N W b W	S S W	N W	W 4 N	4·14	...
4	·486	·461	·507	·489	44·7	52·6	47·0	48·9	— 8·9	·257	·254	·232	·252	88	65	73	74	N	W	Calm	W 9 S	4·23	...
5	·490	·451	·522	·490	49·7	63·4	46·3	54·4	— 3·7	·245	·419	·258	·306	70	74	83	73	W b N	W b N	N N W	W 15 N	6·60	...
6	·596	·532	·490	·533	53·5	67·2	49·7	55·7	— 2·7	·286	·450	·272	·314	71	70	77	71	Calm	S b W	Calm	S 14 E	1·87	Inap.
7	·396	·278	·312	·326	48·1	55·5	52·0	52·1	— 6·7	·296	·385	·362	·351	89	89	95	91	Calm	N E b N	W	N 37 W	2·97	0·290
8	·349	·364	·407	·376	49·5	62·2	48·5	54·4	— 4·7	·303	·311	·257	·319	87	56	77	76	N W	W N W	Calm.	...	...	0·010
9	·425	·361	·272	·331	51·7	70·4	50·6	56·8	— 2·7	·307	·442	·262	·332	81	61	72	73	Calm	W b S	Calm.	...	...	0·490
10	28·990	28·996	—	—	50·3	62·5	—	—	—	·360	·506	—	—	100	91	—	—	Calm	W		...	...	0·205
11	29·271	29·368	·473	·384	47·0	54·6	44·2	48·7	—11·3	·267	·228	·230	·245	84	54	81	73	N W	W	W	...	...	...
12	·545	·647	·734	·649	43·5	61·0	44·2	50·3	—10·0	·221	·290	·221	·250	79	55	77	69	S W	W b N	W b N	W 10 N	10·01	...
13	·773	·722	·714	·736	51·0	63·4	48·5	53·4	— 7·2	·248	·266	·277	·259	68	47	83	66	N W b W	S b W	N W	W 41 S	7·22	...
14	·695	·604	·576	·608	57·1	72·5	59·4	64·1	+ 3·3	·283	·438	·318	·345	62	58	64	59	N W b W	S S W	W b N	W 27 N	9·65	...
15	·449	·393	·458	·427	58·0	71·8	58·1	63·6	+ 2·4	·365	·422	·362	·373	77	55	76	67	W	N W b W	S W b S	W 29 N	9·24	0·015
16	·448	·436	·485	·463	56·4	63·4	60·3	61·4	+ 0·1	·394	·408	·371	·393	89	71	73	74	N b W	S W	N	N 8 E	3·95	...
17	·701	·738	—	—	54·6	58·6	—	—	—	·278	·360	—	—	66	75	—	—	N E b N	E b S	N b E	E 28 N	4·49	...
18	·811	·754	·683	·731	58·7	63·9	56·7	60·2	— 1·7	·390	·276	·390	·328	81	47	87	66	N E b N	E	E N E	E 12 N	7·03	0·175
19	·577	·476	·482	·503	54·1	54·1	53·0	53·2	— 8·9	·379	·383	·382	·369	93	94	97	93	N E	N E	Calm.	E 6 N	6·33	0·335
20	·522	·498	·473	·501	53·1	60·7	54·7	55·9	— 6·6	·368	·415	·361	·384	93	80	86	88	Calm	S S W	E	S	2·85	...
21	·486	·452	·393	·442	49·4	63·5	61·2	58·2	— 4·4	·324	·456	·487	·422	93	80	92	88	N E b E	E b S	E N E	E 6 N	5·30	0·580
22	·384	·426	·568	·462	58·9	72·7	64·4	65·5	+ 2·5	·452	·536	·482	·483	93	69	82	80	E b N	N N W	N b W	N 19 W	7·77	...
23	·644	·665	·634	·640	61·8	68·9	62·0	64·0	+ 0·9	·420	·505	·439	·454	78	73	82	78	N b W	S E b S	N E	E 23 N	5·03	0·875
24	·564	·471	—	—	58·9	66·4	—	—	—	·435	·483	—	—	89	76	—	—	N E	N b E	N N W	N 3 E	10·36	0·045
25	·499	·478	·549	·511	60·9	69·1	62·8	64·9	+ 1·4	·430	·506	·419	·457	82	73	75	76	N W b N	S	N W	W 13 S	4·54	0·060
26	·620	·624	·655	·636	59·3	70·7	58·4	62·9	— 1·0	·465	·567	·432	·487	93	78	91	87	S W b S	S	S S W	S 15 W	5·57	0·110
27	·703	·673	·601	·654	61·7	74·7	66·6	67·6	+ 3·6	·490	·584	·594	·561	91	70	93	86	S W b S	E S E	S W b S	S 4 E	3·59	0·495
28	,672	·728	·687	·690	65·6	78·1	70·7	72·2	+ 7·9	·557	·696	·626	·631	92	75	86	83	W b N	S	S W b W	S 39 W	5·11	...
29	·676	·587	·553	·604	71·1	85·3	74·0	78·7	+14·3	·670	·786	·707	·722	90	66	87	78	Calm	S b W	W b S	S 37 W	5·65	...
30	·558	·513	·465	·502	76·1	81·5	71·4	77·3	+12·7	·718	·751	·622	·704	82	72	83	78	W S W	S S W	S W	S 20 W	5·83	0·045
M	29·532	29·502	29·514	29·513	55·8	66·7	56·4	59·9	— 1·1	0·381	0·452	0·386	0·406	·84	·69	·83	·78	3·56	7·88	4·16	W 21 N	5·70	4·070

Highest Barometer...... 29·811, at 6 a.m. on 18th } Monthly range:
Lowest Barometer....... 28·942, at 9 30 a.m. on 10th } 0·869 inches.
Highest registered temperature 91°·5, at p.m., 29th } Monthly range:
Lowest registered temperature 36°·2, at a.m. on 12th } 55°·3.
Mean Maximum Thermometer.............. 68°·89 } Mean daily range:
Mean Minimum Thermometer....... ...... 50°·68 } 18.21
Greatest daily range.........30°·8, from p.m. of 5th to a.m. of 6th.
Least daily range ....5°·2, from p.m. of 19th, to a.m. of 20th.
Warmest day....... 29th. Mean temperature......78°·72 } Difference,
Coldest day......... 11th. Mean temperature......48°·65 } 30°·07.
Greatest intensity of Solar Radiation, 106°·0 on p.m. of 29th } Range,
Lowest point of Terrestrial Radiation, 28°·6 on a. m. of 13th } 77°·4.
Aurora observed on 4 nights: viz. on 8th, 10th, 16th and 22nd.
Possible to see Aurora on 17 nights. Impossible on 13 nights.
Raining on 17 days. Raining 74·1 hours; depth, 4·070 inches.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North—1276·82 West—1516·51 South—975·59 East—746·52.
Mean direction of Wind, W 21° N. Mean velocity 5·70 miles per hour.
Maximum velocity, 19·5 miles per hour, from 11 a.m. to noon on 15th.
Most windy day, the 24th; mean velocity, 10·36 miles per hour.
Least windy day, the 6th; mean velocity, 1·87 " "
Most windy hour, 1 p.m.; Mean velocity, 8·63 miles per hour.
Least windy hour, midnight; Mean velocity, 3·55 miles per hour.
Mean diurnal variation, 5·08 miles. Mean of Cloudiness, 0·65.
14th. Fire-flies first observed. 15th. Fire-flies numerous this evening.
17th. Halo round the Sun from 11 a.m. to 1 p.m.
18th. Beautiful and very perfect Halo round Sun at noon.
21st. Severe Thunderstorm from 4.30 p.m.
24th. Splendid Rainbow from 7.15 to 7.45 p.m. 25th. Do. at 7.30 p.m.
25th. Pollen fell in small quantities in this day's rain.
26th. Pollen fell in considerable quantity in the rain of this night.
27th. Severe Thunderstorm from 7.30 to 10 p.m.
28th. Sheet Lightning and distant Thunder at midnight.
30th. Incessant Sheet Lightning from 10 p.m.

The *Components* of the Wind, and its *Mean Velocity*, are not perfect for this month, the Anemometer having been dismounted from its old position on the 8th, was repaired and mounted on the New Tower of the Observatory on the 12th, consequently the results do not include those quantities from the 8th to the 12th inclusive. The quantity of Rain which fell during the month has been 1·028 inch above the average, and the number of days on which Rain fell exceeds that recorded for any other June of the series. The Mean Temperature of this month has been 1°.5 below the average of the last 16 years, the first three weeks having been very cold, whilst the last week was excessively warm. The 29th was the warmest day in any June on the records of the Observatory.

Comparative Table for June.

YEAR.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Wind. M'n Direc.	Mean Velocity in Miles.	
1840	59·8	—1·6	78·5	37·1	41·4	11	4·860	...		
1841	65·6	+4·2	92·8	45·7	47·1	9	1·560	...	0·36	Miles.
1842	55·6	—5·8	73·9	28·0	45·9	15	5·755	...	0·31	Miles.
1843	58·4	—3·0	81·3	28·5	52·8	12	4·595	...	0·27	Milesr
1844	59·9	—1·5	82·8	33·1	49·7	9	3·535	...	0·19	Miles.
1845	61·0	—0·4	83·6	40·9	42·7	11	3·715	...	0·27	Miles.
1846	63·3	+1·9	83·3	41·5	41·8	10	1·920	...	0·32	Miles.
1847	58·4	—3·0	78·3	36·7	41·6	14	2·625	...	0·30	Miles.
1848	62·9	+1·5	92·5	38·3	54·2	8	1·810	W 29 N	4·51	Miles.
1849	63·2	+1·8	84·9	45·2	39·7	7	2·020	E 20 S	3·32	Miles.
1850	64·3	+2·9	83·2	49·0	34·2	10	3·345	W 30 S	4·54	Miles.
1851	59·2	—2·2	79·2	41·2	38·0	11	2·695	S 2 W	4·42	Miles.
1852	60·8	—0·6	86·1	43·6	42·5	10	3·160	W 13 S	4·09	Miles.
1853	65·5	+4·1	86·3	43·3	43·0	9	1·550	N 14 W	3·67	Miles.
1854	64·1	+2·7	88·7	47·4	41·3	9	1·460	N 10 E	4·12	Miles.
1855	59·9	—1·5	90·7	40·6	50·1	17	4·070	W 21 N	5·70	Miles.
									0·29	lbs.
M'n.	61·37		84·13	40·01	44·12	10·7	3·042		4·30	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.—June, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inches	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	29·770	29·740	29·680	67·5	71·8	65·7	·534	·681	·555	·81	·88	·89	S S W	S W	S b W	6·26	5·00	7·13	...	Cir. Str. 10.	Cum. Str. 10.	Cum. Str. 10.
2	·680	·750	·700	66·4	66·6	63·2	574	576	547	89	90	99	S b W	S	S	13·53	2·24	3·25	0·533	Do. 8.	Rain.	Do. 10.
3	·689	·705	·734	61·0	72·9	60·6	530	578	494	99	74	94	S W	W S W	S b E	7·74	8·78	0·87	0·433	Rain.	Str. 8.	Str. 4.
4	·610	·687	·735	53·6	57·4	51·0	386	462	351	96	94	90	W	W b S	W S W	2·37	7·89	4·05	0·280	Rain.	Cum. Str. 8.	Do. 2.
5	·682	·678	·740	54·0	56·3	50·9	326	456	315	76	74	81	W b S	W S W	W	5·29	3·67	6·87	...	Cum. Str. 6.	Do. 9.	Clear.
6	·700	·725	·820	53·0	69·5	57·1	301	414	355	73	58	74	W	W	W b S	4·17	6·20	11·01	...	Cirr. 4.	Cir. 4.	Str. 2.
7	·721	·650	·489	55·6	65·8	53·0	351	473	389	79	76	95	S S W	S E b E	N E b N	0·73	0·13	4·62	0·300	Cir. Cum. Str. 9.	Cum Str. 10.	Rain.
8	·441	·500	·671	51·1	63·0	51·1	350	388	301	89	67	79	N N W	W b N	W b S	10·07	6·07	6·28	0·400	Cum Str. 4.	Do. 2.	Clear.
9	·580	·670	·691	47·1	68·0	50·7	291	582	326	86	85	87	W	W	W b S	3·79	7·30	7·03	...	Do. 8.	Do. 2.	Do.
10	·521	·269	·381	53·0	55·8	58·0	337	422	479	81	99	99	E N E	E N E	W S W	0·81	5·00	1·25	1·343	Do. 8.	Rain.	Showers.
11	·546	·485	·611	54·2	61·7	52·2	428	431	326	99	79	81	W S W	W S W	W S W	1·81	7·50	7·88	0.230	Rain.	Cum. Str. 4.	Str. 4.
12	·700	·811	·800	46·8	54·0	49·1	282	349	336	85	81	93	W S W	W S W	W S W	9·95	6·64	2·87	...	Clear.	Str. 10.	Do. 10.
13	·946	·985	·950	53·0	69·1	55·6	337	392	372	81	55	84	W S W	W S W	W S W	3·38	4·20	6·63	...	Cum. Str. 4.	Cir. Str. 6.	Clear.
14	·830	·785	·739	56·9	72·5	57·0	363	473	316	79	61	67	S W b W	W	W b N	2·81	2·83	10·70	...	Clear.	Clear.	Str. 10.
15	·504	·585	·681	55·9	59·7	57·3	408	402	355	90	79	74	W b S	N b W	N W b W	4·77	6·63	3·87	0·256	Shower.	Cum. 8.	Cir. Str. 3.
16	·721	·661	·770	58·7	69·2	52·1	367	351	251	75	49	64	W	W N W	N N W	Calm	10·33	7·00	...	Clear.	Cirr. 2.	Clear.
17	·921	30·000	30·087	43·0	70·4	54·1	233	442	304	79	60	70	N N W	W b S	E N E	9·33	1·80	Inap.	...	Do.	Clear.	Do.
18	30·101	30·150	30·071	47·0	72·2	56·2	271	367	363	80	47	79	N E	N E b E	S S E	Calm	2·65	0·37	...	Do.	Do.	Do.
19	29·987	29·945	29·871	58·0	71·8	62·0	441	506	397.	90	67	71	N E b E	S	S b E	0·44	2·97	5·08	...	Do.	Cirr. Str. 2.	Cir. Str. 10.
20	·800	·770	·760	53·0	61·0	56·3	371	442	432	90	81	94	E	N E	N E b N	5·20	3·91	1·64	0·466	Rain.	Str. 10.	Str. 9.
21	·780	·778	·789	54·8	74·0	67·1	349	532	540	81	64	83	W S W	W b S	W S W	0·78	3·12	3·14	...	Str. 10.	Cir. Cum. 3.	Cir. Cum. 2.
22	·720	·714	·780	61·6	72·1	60·2	512	670	494	99	86	94	S W b W	N E b E	N E	Calm	2·12	1·04	0·880	Rain.	Str. 6.	Str. 8.
23	·978	·964	·987	58·0	81·2	60·7	389	704	441	79	68	84	N E b E	S S W	S S W	Inap.	4·08	Calm	...	Clear.	Cir. Str. 4.	Cir. Str. 4.*
24	·975	·946	·885	55·1	71·8	60·0	394	648	494	88	86	94	E	E b S	E b N	Calm	0·62	2·28	0·600	Cirr. Str. 4.	Rain.	Rain.
25	·743	·790	·840	59·0	65·6	59·0	506	555	506	1·00	89	1·00	E N E	N E	N E	11·36	3·90	4·97	1·903	Rain.	Cum. Str. 9.	Cir. Str. 8.†
26	·930	·900	30·024	64·1	70·1	63·5	571	572	488	96	79	84	S W b S	W S W	W	0·32	3·09	6·01	...	Cir. Cum. Str. 4.	Cir. Cum. Str. 8.	Str. 8, dist. th.
27	30·031	30·005	30·000	67·0	81·9	70·6	544	692	659	83	64	90	W b S	W b S	W S W	7·50	6·25	5·70	Inapp.	Clear.	Clear.	Str. 4.
28	29·835	29·726	29·860	66·6	89·2	73·3	605	715	659	95	53	82	S b E	W S W	S W b W	0·54	1·82	5·00	Inapp.	Showers.	Do.	Clear.
29	·661	·515	·546	70·8	93·8	74·2	659	940	751	90	68	90	W b S	S W b S	W b S	4·30	9·39	6·07	0·793	Clear.	Nimb. 4, dis. th.	Cir. Str. 9.
30	·614	·523	·502	80·9	94·4	79·0	617	854	763	61	52	78	W b S	S W	W b S	1·01	0·82	2·08	...	Do.	Cir. Str. 2.	Clear.

Barometer ....
- Highest, the 18th day .... 30·150
- Lowest, the 10th day .... 29·269
- Monthly Mean .... 29·757
- " Range .... 0·881

Thermometer
- Highest, the 30th day .... 95°·3
- Lowest, the 17th day .... 39°·7
- Monthly Mean .... 62°·39
- " Range .... 55°·6
- Mean Humidity .... ·809

Greatest Intensity of the Sun's Rays .... 124°·1

Rain fell on 15 days, amounting to 8·317 inches, and was accompanied with thunder on two days; raining 83 hours 50 min.

Amount of Evaporation, 2·61 inches.
Most prevalent Wind, W S W. Least prevalent Wind, E b S.
Most Windy Day, the 25th day; mean miles per hour, 6·47.
Least Windy Day, the 17th day; mean miles per hour, 0.60.
Aurora Borealis invisible. Might have been seen on 12 nights.
Ozone.—The amount of Ozone has been rather large in quantity.

The electrical state of the atmosphere has been marked by rather high intensity; and on the 26th and 29th days indicated a very high tension of a negative character.

Yellow matter observed in the rain which fell on the 2nd and 29th days.
Parhelia at 7 p.m. on the 21st day.

* Lunar Halo, diameter 41°. † Lunar Halo, diameter 47°.

Monthly Meteorological Register, Quebec, Canada East, June, 1855.

BY LIEUT. A. NOBLE, R. A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Tension of Vapour.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P. M.	10 P. M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·930	29·816	29·805	29·850	50·1	68·5	50·9	56·5	0·276	0·353	0·312	0·314	78	52	85	72	E N E	Calm.	W	7·2	0·0	6·2	·118	...	
2	·497	·590	·620	·569	64·0	52·3	46·3	54·2	·506	·364	·294	·388	87	95	94	92	Calm.	E N E	E N E	8·0	13·9	24·8	·712	...	
3	·612	·527	·562	·567	46·0	55·5	50·7	50·7	·305	·395	·353	·349	100	92	97	96	E N E	E b N	E b N	11·3	12·4	11·3	·142	...	
4	·469	·384	·491	·448	52·0	61·9	50·5	54·8	·370	·429	·314	·371	97	79	86	84	E N E	S W	S S W	11·3	10·0	13·4	·039	...	
5	·452	·376	·534	·454	50·0	56·6	51·0	52·5	·300	·269	·321	·297	85	61	87	78	W	S W	Calm.	11·3	10·0	13·4	·013	...	
6	·510	·464	·518	·497	49·5	66·6	58·7	58·3	·294	·208	·296	·266	85	33	62	60	W S W	W	Calm.	8·0	13·4	0 0	...	...	
7	·565	·454	·294	·438	53·0	63·2	51·6	55·9	·252	·315	·343	·303	64	56	91	70	E N E	E N E	Calm.	10·0	7·2	0·0	·607	...	
8	·200	·292	·370	·287	52·1	53·4	48·8	51·4	·334	·229	·179	·247	87	58	53	66	W S W	NWb N	W b N	5·2	13·9	8·8	·052	...	
9	·422	·411	·502	·445	48·8	55·0	49·2	51·0	·276	·283	·281	·287	81	67	81	80	W	N W	W	8·0	10·0	2·0	·264	...	
10	·538	·399	·268	·402	49·6	51·3	53·6	51·5	·300	....	·394	....	86	...	98	...	E	E N E	E N E	3·8	22·7	17·9	1·418	...	
11	·287	·186	·360	·278	45·0	61·9	52·9	53·3	·285	·487	·351	·374	96	90	89	92	Calm.	W S W	S W	0·0	7·2	15·2	·689	...	
12	·545	·595	·714	·618	49·0	56·5	47·8	51·1	·268	·248	·280	·265	78	55	86	73	S W	W	W	10·0	10·0	13·9	·066	...	
13	·771	·744	·733	·749	48·5	62·1	52·8	54·5	·282	·253	·318	·284	84	47	81	71	W	W S W	S W	10·9	13·4	3·8	...	...	
14	685	·586	·527	·599	50·2	61·2	52·3	54·6	·293	·298	·230	·274	81	56	86	74	E	E N E	N	3·8	5·2	3·8	...	...	
15	·387	·363	·410	·387	52·0	64·2	58·1	58 1	·332	·315	·295	·314	87	54	63	68	Calm.	S W	W N W	0·0	5·2	6·2	...	...	
16	·461	·432	·588	·494	53·1	64·9	51·0	56·3	·309	·250	·185	·248	79	59	50	63	S b W	W N W	W N W	6·2	13·9	13·9	...	...	16th. Squalls, the wind
17	·722	·752	·888	·787	49·0	64·3	53·0	55·4	·184	·224	·183	·197	54	69	46	56	N W	N W	N W	21·3	8·0	6·2	...	...	varying in velocity from 22
18	·996	·913	·893	·934	47·6	70·8	58·7	59·0	·216	·240	·306	·254	66	33	63	54	Calm.	S W	N	0·0	2·2	2·0	...	...	to 32 miles per hour.
19	·894	·780	·741	·805	52·9	73·0	63·8	63·2	·202	·266	·300	·256	51	34	52	46	Calm.	N N E	S	0·0	2·0	10·0	...	...	
20	·760	·675	·603	·679	55·2	53·0	54·3	54·2	·259	·386	·407	·351	61	98	98	86	S E	E N E	E b N	3·8	11·3	17·9	·818	...	
21	·588	·597	·588	·591	54·0	64·4	59·4	59·3	·387	·430	·432	·416	95	74	87	85	Calm.	W	S W	0·0	8·8	5·2	...	...	
22	·586	·557	·617	·587	59·0	57·8	57·3	58·0	·454	·435	·440	·443	92	93	96	94	Calm.	E	N N W	0·0	13·9	5·2	·515	...	
23	·755	·766	·753	·758	52·2	72·8	67·0	64·3	·363	·454	·...	....	91	82	...	...	Calm.	S S W	W	0·0	8·0	8·0	·765	...	
24	·766	·755	·739	·753	58·0	77·0	66·2	67·1	....	....	·429	....	...	...	64	...	W	Calm.	E	6·2	0·0	2·0	·264	...	
25	·745	·733	·730	·736	60·1	61·2	59·8	60·4	·462	·423	·438	·441	91	81	87	86	E	E N E	E N E	13·9	21·3	22·7	·475	...	
26	·762	·754	·706	·741	57·4	67·0	59·6	61·3	·445	·513	·466	·475	97	80	94	90	E N E	E N E	Calm.	19·7	8·8	0·0	·092	...	
27	·763	·745	·745	·751	62·2	79·9	71·1	71·1	·494	·469	·514	·492	91	48	70	70	S W	W	W N W	10·0	14·3	3·8	...	...	
28	·757	·693	·682	·711	68·3	86·3	73·3	76·0	·565	·424	·392	·460	85	35	74	65	Calm.	S W	W S W	0·0	8·8	5·2	...	...	
29	·635	·502	·561	·566	69·3	84·2	71·8	75·1	·630	·715	·568	·638	91	63	75	80	W S W	W S W	N N W	5·2	10·0	10·0	·016	...	29th. Lunar Halo at 10
30	·664	·634	·582	·627	60·0	66·0	57·9	61·3	·310	·355	·346	·337	61	57	74	64	E N E	E N E	E N E	16·0	19·0	21·3	...	...	p.m. Aurora at 11 p.m.
M	29·631	29·576	29·604	29·6037	53·94	64·43	56·65	58·34	0·344	0·355	0·340	0·346	82	64	78	75				6·77	10·16	9·14	7·065		

Maximum Barometer, 6 a.m. on the 18th	29·996
Minimum Barometer, 2 p.m. on the 11th	29·186
Monthly Range	·810
Monthly Mean	29·6037
Maximum Thermometer on the 29th	88°·1
Minimum Thermometer on the 8th	43·2
Monthly Range	44·9
Mean Maximum Thermometer	66·94
Mean Minimum Thermometer	51·82
Mean Daily Range	15 12

Mean Monthly Temperature	58·34
Greatest Daily Range of Thermometer on 29th	28°·1
Least Daily Range of Thermometer on 20th	4°·7
Warmest Day, 28th. Mean Temperature	76·0
Coldest Day, 1st. Mean Temperature	49·8
Climatic Difference	26·2

Possible to see Aurora on 11 Nights.
Aurora visible on 7 Nights.
Total quantity of Rain, 7·065 inches.
Rain fell on 18 days.

The thick lines shew the general direction of the Main Drains or Canoe Canals.

MAP
of the
TOWNSHIP of COLCHESTER
To Illustrate
MAJOR LACHLAN'S PAPER.

Page 321.

The Canadian Journal.

TORONTO, SEPTEMBER, 1855.

On the formation of a Canal between Lakes St. Clair and Erie,

And the foundation of a Town and Harbour at the Mouth of the Two Creeks, in the Township of Romney, in connection with the establishment of an extensive system of Drainage, by which near a Million of Fertile Acres would be redeemed in one District. With an illucidatory Map.

BY MAJOR R. LACHLAN, MONTREAL.

(*Concluded from page* 303.)

To the foregoing descriptive sketches of the localities for both undertakings, (*see August number of the "Canadian Journal," page* 306,) I might have added further desultory remarks demonstrative of the great benefits sure to result from their successful accomplishment, as affecting not alone the immediately surrounding country, but the whole district, and even the Province at large; but, contenting myself with what had been advanced by Mr. Elliott, and the writer in the *Patriot*, I merely observed that, taking it for granted that all the advantages expected from the opening of the proposed canal would be realized, the first questions that would be asked would be: what should be the express nature of the canal? and, what would be the most economical way of executing the work? To which I would unhesitatingly reply, that, of course, it ought to be a *ship canal;* but that that involved two considerations, namely, whether, as proposed by Mr. Elliott, it should be only a simple cut *without locks*, which with a fall of between five and six feet in fifteen miles might perhaps be practicable, or whether it should be furnished with at least one lock at its southern extremity for at once moderating the current, which at particular seasons would doubtless be very rapid, and furnishing the village with a valuable permanent water-power for milling purposes, in a part of the country where such privileges are much required. Without, however, pretending to have investigated the probable results of either plan very closely, I was content to observe that I inclined to the latter plan, although the most expensive, as calculated to keep the waters in the canal under subjection; whereas, were they left to chance, as an open cut, it was not improbable that the current would in the course of a very short time scoop out a channel of far greater magnitude than might be desirable. Add to which, though I did not altogether acquiesce in Mr. Elliott's expectations of its lowering the surface of Lake St. Clair to the extent predicted by him, it was impossible to say what effect the uncontrolled expansion of such an outlet would produce on the present level of that lake. The expense of the undertaking also I had not attempted to estimate; but, considering the trifling lockage required and the *supposed* absence of all rocky obstructions, one might hazard a supposition, from a known rate of £3,000 per mile for a canal thirty feet wide and eight feet deep, that the whole expense of excavation would not much exceed £40,000, a sum very far short of the value of the rich lands that would thereby be reclaimed from a state of utterly unproductive, and, at times, even pestilential marsh!

In taking this cursory view of the subject I had, of course, confined myself to the formation of *the canal* alone, as a navigable channel of communication between the two lakes. It now, however, became necessary to connect that branch of the undertaking with the proposed town and harbour at its southern termination. But, fortunately, that would involve very little additional expense; for, taking it for granted that the eligible character assigned to the *former* was correct, its rapid location by settlers would be sure to follow; and, therefore, the only obstacle to the successful formation of the *latter*, worth considering, would lie in the removal of the bar or sand-bank liable to form at the mouth of the creek. And even that need not detain us for a moment; for if such obstructions can be obviated elsewhere, and, as already mentioned, could here be so easily overcome in the course of a single night by scooping out a trifling channel with the hands, by way of amusement, what might not be expected to be accomplished by the permanent action of the current of the canal, guided between Piers at its exit into the lake!

Having thus supplied—what had been omitted by the Municipal Council—such data as I thought might reasonably justify the Government in authorising the Board of Works to undertake at least *a preliminary survey*, I refrained from saying more on *that* subject. But I could not help adding that being impressed with a conviction that very great public benefits would be derived from a scientific examination of the levels of *all the lake-shore Townships*, with a view to the institution of a regular sytem of Public Drainage, and the redemption thereby of hundreds of thousands, if not a million of acres of the richest land; and being of opinion that in a young and rising country like Canada, the general economy of harbours, bridges, and, though last, not least, *Public Drainage*, should be under the sole control of Government,* I trusted that I should not be deemed presumptuous, should I hereafter be led to draw the attention of the Government to that important subject, particularly as I was prepared to prove that in my own Township alone the application of a trifling sum in drainage would at once convert not less than 6,000 acres of the finest land from a state of waste marsh into smiling farms; and that, to my certain knowledge such was more or less the case in the whole of the other lake-shore Townships.†

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* Such is the case with the harbours in the United States, without any reference to profit or otherwise, even to furnishing the funds from the *Fœderal* purse; and, I believe that some years ago Mr. Killaly also expressed a similar opinion, at the very time that, strange to say, the Rondeau was being abandoned by the Government to a private Company, because found to be unproductive. Whereas, had the Government been in the first instance content to construct a mere harbour of refuge, with a light-house at its mouth, and left the rest to futurity, they would have accomplished all that was wanted in such a situation, at half the expense incurred.

† In justice to the important public objects advocated, I now feel constrained to state, with all candor, that I was in due time honoured with an acknowledgement of the communication from which the foregoing details are extracted, conveying the Governor-General's thanks for my suggestions, and apprising me that the subject had been submitted to the Commissioner of the Board of Works; but that, unfortunately, that officer had expressed a very unfavourable, though *unofficial*, opinion respecting the Canal, which was transmitted for my information. Conceiving such a mode of proceding to be premature—the sole object of the Municipal Council and myself being to obtain a *preliminary* survey, on which to establish further action or rejection—and the Canal alone being alluded to by the Commissioner, and some of my language even on that head appearing to have been inadvertently misunderstood, as well as misquoted, I felt bound to offer some further explanation, in the hope of so far setting matters right; as I should have regretted exceedingly that any blunders on my part respecting the Canal, should stand in the way of either the proposed Town and Harbour, or the drainage of so large a tract of valuable country. I accordingly lost no time in referring to the fact that instead of profess-

Such being the unsatisfactory termination of my long-continued, and sometimes expensive, disinterested exertions, it will not be thought surprising that I should have felt so chagrined and disappointed that I had ever since refrained from further agitation of the subject. But more propitious times appearing to have at length arrived, I *now* venture to add to the foregoing narrative even the following rather lengthy particulars on the subject of *Drainage*, extracted chiefly from a Topographical Sketch of the Township of Colchester, drawn up by myself, as of sufficient public interest to repay the perusal.

"The surface of this Township, though partaking of the general flat character of the District, is far from being a dead level, being in many quarters enlivened by large tracts of undulating or rolling land, and in others checkered by detached stony rises, besides being traversed by a rather continuous ridge running irregularly in a west and east direction, two or three miles retired from the lake, which, forming a barrier to the drainage of the interior lakeward, forces a portion of the surface waters westward into the River Canard, and the rest south-eastward by several channels into Cedar Creek.*

"The existence of similar ridges is a distinguishing feature in nearly all the other lake-shore Townships; in some of which, as in Raleigh, they approach to within half a mile of the beach, and not only arrest the drainage of the back lands towards the lake, but produce a succession of open marshy tracts, which become nearly dry in summer, but are annually flooded until they attain a certain height, when their waters find a partial vent by various outlets, from pools or ponds, which appear to have at one time been of a lower level, and (in this Township at least) to have owed their present elevation to artificial dams, formed by that sagacious amphibious animal, the beaver, once very common, but now rarely met with in this part of the country.† The ridges alluded to are also remarkable for being in some instances composed of beds of small gravel and sand, mixed with isolated masses of rock; and in others of a congeries of large imbedded boulders of granite, limestone, and other rocks, some of which measure from ten to fifteen feet in surface.

"The marshes in Colchester, explored by myself, are four in number, and known by different names, such as Hog Marsh, Roach's Marsh, Long Marsh, and Round Marsh. Of these Hog Marsh, which is partly in Gosfield, occupies about 1,200 acres, and is generally about three miles and a half long, and one and a half broad, and is remarkable as at the same time draining westerly, and giving birth to the little River Canard, which falls into the Detroit above Amherstburg, and also S. S. Eastwardly into Cedar Creek, which empties itself into Lake Erie. Roach's marsh, which lies further west, and also feeds the Canard on one hand and Cedar Creek on the other, contains about 2,000 acres, and is generally about three miles and a half long. Long Marsh, still further west, contains about 1,600 acres, and varies in length from three to four miles, and in breadth from a quarter to three-quarters of a mile. And Round Marsh, connected with the southern extremity of Long Marsh, consists of about 600 acres: making 5,400, or say 6,000 acres in all—a rather large proportion of one Township; exhibiting in the wet and winter months extensive sheets of solitary water or ice; but, as they gradually dry up during summer, assuming the more cheerful aspect of broad verdant prairies, hemmed in by dark forests, resorted to alike by roving wild deer and domestic cattle from the neighbouring farms, and in autumn furnishing an abundant supply of coarse hay to whoever may be disposed to cut and stack it. Though thus not altogether worthless, it would, of course, be far more desirable to have these rich flats subjected to the plough; and there seems to be no great difficulty in the way; for it is believed, from a rather careful, though *not* scientific examination of their levels, that being in general shallow, and the intervening ridges only a few feet in height, they might all be drained and converted into productive farms at little expense, by simply cutting a rather broad ditch due north from Lake Erie, past the village of Colchester to the ninth Concession, until it approaches the River Canard, that would at once serve the purpose of a small Canoe Canal, and, by throwing the excavated materials all on one side, furnish a good elevated road through a part of the country in which, in wet seasons, such a communication is much wanted. Add to which the same cut might perhaps be made to supply a considerable water power, for the benefit of the village."

In further proof that the proposed drainage of the lake-shore Townships in general, and of Colchester in particular, was not altogether a visionary scheme, it may be here added, commencing with my own Township, that after estimating as well as I could the difference of the level inland, I became persuaded that a depth of three or four feet, and a width of six past the village, would be sufficient, and that the greater additional cutting required through the first ridge, about one mile and a half inland, need not in any part be more than six feet, and that the expense, therefore, would not be very great, while the benefits arising from such a measure would be incalculable.

Impressed with this conviction, and all the other Townships partaking more or less of the same physical character, I had, in 1841, been encouraged to open the subject to Lord Sydenham, during a personal interview at Kingston, in the course of which I remarked that as in Colchester the great bulk of the lands to be drained belonged to the Clergy Reserves and the Canada Company's block, the principal part of the expense would have to be borne by them, but that an equitable assessment per acre might also be levied on the lands of private individuals who benefited by the drainage: an arrangement in which his Lordship acquiesced, in addition to evincing his general approbation of the project, by particularly requesting me to mention the matter to the then Surveyor General and Commissioner of Crown Lands. I had, however, only an opportunity of seeing the former, when he also seemed to take much interest in the proposal, though he confessed that he saw little prospect of being then able to bring it forward with success. I was, therefore, induced to postpone all further agitation of the subject till I should have an interview with the Commissioner of the Canada Company; and this I had at Toronto on my way homewards, when Mr. Widder assured me that he approved much of the scheme, and that if I could only get Governmen

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ing to have attempted any detailed estimate, I had pointedly avowed having refrained from so doing, and had merely hinted that, *in the absence of all such*, one might *hazard a supposition* (from a cursory comparison of several American estimates, from which I quoted a few figured details) that the expense of the proposed Cut between Lakes St. Clair and Erie, would not much exceed £40,000, and that, being no professed Engineer, any misunderstanding on my part was excusable; and that I, therefore, trusted that Government would still be disposed to authorise the trifling expense required to carry out even the most elaborate preliminary survey, from the results of which the Board would then be enabled to ground an authoritative opinion. Nothing further, however, was ever heard on the subject.

* See the Township of Colchester in the annexed map, in which the marshy tracts are pretty correctly delineated.

† It was proposed that wherever these elevated ponds or basins occurred the dams should be cut through, so as to allow the water to flow off into the main drain or other outlet

to move in the matter I might depend on the Canada Company not being backward in contributing their full share towards the success of the undertaking; but there the matter rested.

With respect to my remaining notes on drainage, as the object aimed at referred chiefly to the lake-shore Townships, I shall here pass over those of Sandwich and Malden, as well as those lying along Lake St. Clair, though the public lands in all of them would be much benefited thereby.

With regard to Colchester, as already observed, I proposed the main drain to be of a width and depth sufficient to be used as a canoe Canal for bringing small supplies from the back settlements, at times when the roads are impassable, and to run straight north from the lake, past the west boundary of the village, into the Round Marsh, and from thence through the 2nd, 3rd, 4th, and 5th Concessions, until it struck upon the borders of Long Marsh, and from thence through the 6th, 7th, and 8th Concessions, and across Roach's Marsh, until it approached the River Canard, near the Malden Road, receiving right and left a few small cross branches at the different Concession roads, and thus draining a great extent of scattered low land, in addition to the main inundated tracts of Round, Long, and Roach's Marshes. It was also proposed that another cut should be made from the south-east end of Roach's Marsh to Cedar Creek, with cross ditches at the division roads of the different Concessions; while a third might be made to lead from Hog Marsh (in which the River Canard takes its rise) into the branch of Cedar Creek called Banks's Creek, so as to drain a great portion of the west half of Gosfield.

Regarding Gosfield generally my positive information is rather limited, but it is well understood that though most of it is high and dry, great benefit would be derived from judicious drainage in many parts of it.

With respect to Mersea, which is the next Township, I learnt that there is also much wet land in it; and that the front portion drains towards Lake Erie by numerous creeks, of which Sturgeon Creek is the principal, into the long marshy projecting tongue of low land called Point Pelé; but I never had a good opportunity of thoroughly examining this Township, though desirous of doing so, with the view of ascertaining whether a harbour of refuge could not be established at the mouth of Sturgeon Creek.

To the east of Mersea lies the Township of Romney, in which it is proposed to establish the much desired town and harbour, and of which, therefore, it is unnecessary to take further notice here.

The next Township, with the exception of a small triangular portion of Tilbury, is Raleigh, the northern half of which, from the 12th Concession, drains north by a labyrinth of creeks into the Thames, parallel with which also there is a long marshy track at about one and a half mile distance; while the drainage of the southern portion becoming interrupted by a gravelly ridge, in some parts not more than half a mile from Lake Erie, escapes by many springs through a sandy substratum, which frequently produces along the undermined lofty bank of the Lake extensive land slips of a very singular and even picturesque appearance, the subsidence often taking place in a succession of steppes or stages, leaving the trees and shrubs growing undisturbed. Here, it may be observed, the banks of the Lake are in some parts 70 and 80 feet high.

A similar character prevails in the next Township of Hawich, with the exception that the southern portion slopes towards the low marshy track north of the Roudeau, and that remarkable projecting point of low land called Point aux Pins, while the northern surface waters search their way by a variety of outlets, into a branch of the Thames called McGregor's Creek.*

The northern half of the fine Township of Howard, which is the next, going eastward, also drains north into McGregor's Creek, while the southern portion slopes towards Lake Erie, and finds a vent for the greater part of its surplus waters through different branches of a creek, which, after passing Morpeth, discharges into the Lake near Antrim,—a position where another harbour might, perhaps, be established.

Of the remaining Township of Oxford, I have ascertained little, except that, like the next, it would be much improved by drainage.

To the above details, all that now remains to be added, in conclusion, is, that having with all deference placed the whole question unreservedly before the Institute, in a simple *narrative* form, I am perfectly willing to abide by their decision as to its merits; and that I would, therefore, fain hope that some of our scientific members will ere long be disposed to come to the aid of a patriotic object of great prospective importance and value. In the meantime I remain content with having once more led the way in a good cause,—willing either to support further my own humble opinions hereafter, if necessary, or to bow to the dicision of better informed professional men. There is, however, one collateral subject on which I would, in concluding, wish to add a few words:—namely, that as I have on the one hand alluded to Canada's discreditable abandonment of the honor of being the originator of the Sault Ste Marie Canal, and on the other to the many signal improvements in the navigation of the River St. Lawrence, either already completed or in progress, exemplified in the erection of numerous lighthouses, the formation of splendid Canals, the deepening and buoying off of shallow channels, and the blasting of dangerous rocky impediments in the various rapids, I would also fain hope that there can be no petty political obstacle in the way of a friendly co-operation with the State of Michigan, by which the embarrassing "flats" or clay banks in the River St. Clair, and a few of the shallow channels through Lake St. Clair, such as the North, Eagle, and Walpole Island channels, may be kept thoroughly open and bouyed off, and one or two powerful Steam-tugs employed for towing up sailing vessels during adverse winds and calms, and thereby leave our unrivalled chain of inland waters without a single impediment, from Lake Superior to the Ocean! Nor will it be wondered that I should so pointedly advert to so desirable an international arrangement, when it is considered that more than 350 vessels are employed in the carrying trade of the upper lakes, of which about 50 are paddle steamers and propellers, and the rest sailing craft of various burthen, from the stately three-master to the humble sloop, and that a committee appointed by the Buffalo board of trade to enquire into the amount of losses sustained by owners of vessels detained on the St. Clair Flats alone during the past year, estimated the sum paid for detention, and damage incurred by collision while detained, at between £80,000 and £90,000, besides other expenses for lighterage, towage, &c., swelling the total annual amount to above £160,000!

* For a detailed notice of the Roudeau, see the note at the foot of p. 306.

Coleoptera Collected in Canada.*

By WILLIAM COUPER, Toronto.

For Authorities and Synonyms, see Melsheimer's Catalogue, &c.

CICINDELA

HIRTICOLLIS Say; *albohirta* Dej.; *unita* Kollar.

Jaws black at the points, lip white, with a front marginal row of punctures; antennæ: half their length are of a coppery polish, the points blackish and villous; eyes black; head, thorax, and region of scutellum bronzed, intermixed with a bright green colour, and covered with white hair; elytra of an earthy colour, polished, densely and minutely punctured, with a white spot on the shoulder angles, and a white rim at the apex; body beneath and legs coppery green, and covered with white hairs. Toronto peninsula and Humber bay, not common. Length 5 lines.

Taken by Richardson on the borders of the Mackenzie River, lat. 59°—62° N.

CYCHRUS

VIDUUS Dej.; *unicolor* Say. Newm. (Irichroa) Ent.

Palpi 4, claviform at the apex; antennæ 11-articulate—the basal joint longest: 2d, 3d, and 4th short, black, and polished; 5th to the apex brown pubescent; jaws elongate and toothed; head black and incline downwards; thorax margined—with longitudinal groove through the disc, and two depressions behind, reflecting a steel-blue colour, and densely punctured; elytra polished, with a punctured bluish margin—longitudinally punctured in rows, which become more irregular and rugose near the posterior. The elytra are greatly rounded posteriorly, and do not terminate in a direct point; body beneath black. Toronto, 7th April, under leaves; not common. Length 5 lines.

HISTER

BIMACULATUS Lin.; *obliquus* Say; *reniformis* Jardine's Nat. Lib., vol. vi. pl. 9, fig. 5.

Antennæ deflexed in the centre—the base forms an angle with the apex, which is knobbed; head and thorax black, the latter smooth and polished; elytra longitudinally striate, truncate behind, with a red spot at the extremity of each; abdomen and body beneath black; legs black—tibiæ minutely toothed on the outside; body depressed. Length 2 lines.

One specimen of the above was taken in Toronto in May last, which corresponds with Jardine's figure in the work above cited; but the length of the specimen from which the icon was taken is omitted. "Reniformis" may be synonymous with the European "bimaculatus," which also occurs in America.

ATTELABUS

ANALIS.—*Mels. Cat.*; *similis* Kirby.

Antennæ bluish black; head steel-blue—nearly cylindrical; middle part of the breast steel-blue; thorax dull red; elytra dull red, nearly square, and finely punctured in longitudinal rows; abdomen dull red; legs steel-blue. Toronto; June, on oak leaves, rare. Length 2 lines.

PHYSOCNEMUM

BREVILINEUM Say (Callid). Jour. Acad 3, 413.

Antennæ, head, and thorax black, the latter slightly tuberculate on the top of each side—narrow behind; elytra blackish in front—slightly bronzed behind, and of equal width throughout, with two longitudinal marginal lines on each. Legs blacksh, the femoræ clavate. Toronto, not common. Length 5 lin.

CLYTUS

RURICOLA.—*Mels. Cat.* Antennæ short, and of a rust colour; head and thorax black, the latter globular, and surrounded by a yellow margin; scutellum yellow; elytra blackish, and from the region of scutellum a short yellow fascia points obliquely towards the lateral margin, and behind the latter fascia there is a zigzag yellow band, having a similarity to the letter W, as in clytus *speciosus*. Posteriorly there is a yellow transverse arch; tibiæ and upper section of femoræ of a rusty colour—the latter clavate; posterior legs the longest; pectus spotted with yellow; rings of abdomen yellow. Common throughout the Province. Length 5 lines.

CAMPESTRIS Oliv.; Lec. *terminans* Fabr. 2, 27.

Antennæ rusty-red; eyes black, with a yellow spot on the top of each; thorax globular, slightly hirsute, and sprinkled with yellow hairs in front, with a broad transverse band of grayish hairs behind, and a yellow spot on each side of the posterior section of pectus; femoræ clavate, posterior legs longest. Toronto, not common. Length 6 lines.

HELIOMANES

BIMACULATUS Say; *affinis* Le Conte.

Antennæ longer than the body; head and thorax black, the latter round, and sprinkled with short whitish hairs; elytra greatly abbreviated, covering but half the body, and spread apart behind; femoræ clavate.

From the transparency of the elytra, the folded wings can be seen beneath, which may have led Mr. Say to name it "bimaculatus." Toronto, common on Wild Parsnip. Length 2 lines.

MONOHAMMUS

DENTATOR Fabr. (Lamia) El. 2, 294.

Head and antennæ grey-brown, the latter in ♀ about half the length of those in ♂; thorax grey-brown, spotted with black, having a short spine on each side; scutellum small and whitish; elytra grey-brown, covered with small white and black spots—some of the latter are square, and arranged longitudinally; the apex rounded and covering the abdomen; body beneath and legs grey-brown. Toronto, not common. Length 9 lines.

STRANGALIA

SUBHAMATA.—*Mels. Cat.*; *armata* Haldeman.

Antennæ 10-articulate: from base to 4th joint black, and six are ringed with yellow; head and thorax black, the latter narrow in front; elytra black, tapering behind, with a yellow spot on each shoulder, which widen on both sides of the scutellum, and from the lateral margin, each of which curve towards the suture; the right shoulder spot resembles a comma. On the centre of each elytron is a yellow tooth-like spot. Upper section of femoræ yellow; body beneath blackish. Toronto, rare. Length 5 lines.

PRIOGNATHUS

MONILICORNIS Randall (Ditylus) Bost. Jour. Lec. Agass. Lac. Sup.

Colour dark chestnut; antennæ moniliform, thicker at the apex; head bent down, smooth on top, with a transverse ridge underneath; thorax rounder than in *C. discicollis*. Elytra smooth, margined, and finely punctured. Owen Sound, not common. Length 3½ lines.

CRYMODES

(?) DISCICOLLIS Lec. Agass. Lac. Sup. p. 233.

Palpi 2-moniliform; antennæ moniliform, thicker towards the apex; head bent down in front, densely and finely punc-

* See pages 210 and 256 of this *Journal*.

tured; thorax finely punctured, and slightly depressed on top, with a swelling on each side in front—narrow posteriorly; elytra finely punctured, and of a dark chestnut colour, with slight longitudinal elevations, which are more prominent behind. Toronto, rare. Length 8 lines.

Canadian Coleoptera

IN THE COLLECTION OF FRED. H. IBBETSON,
ASSISTANT COMMISSARY GENERAL, MONTREAL.

This collection was made in two summers. It contains about 780 species (including varieties), of which the following have been determined. They are arranged according to Melsheimer's Catalogue:—

CICINDELA

SEXGUTTATA—*Fabr.* Canada East and West. Common.
PURPUREA—*Oliv.* Toronto, Manitoulin. "
12-GUTTATA—*Dej.* Canada East and West. "
VULGARIS—*Say.* " "
REPANDA—*Dej.* " "
PUNCTULATA—*Oliv.* Toronto. Not common.

CASNONIA

PENSYLVANICA—*Linn.* Peninsula, Toronto. Rare.

GALERITA

JANUS—*Fabr.* Toronto. Mr. Couper. Rare.

BRACHINUS

VIRIDIPENNIS—*Dej.* Canada E. and W. Common.
CORDICOLLIS—*Ibid.* " "

CALOSOMA

CALIDUM—*Fabr.* Canada E. and W. Common.
FRIGIDUM—*Kirby.* Toronto. Mr. Couper.
SCRUTATOR—*Fabr.* " Messrs. Croft and Couper.

OMOPHRON

AMERICANUS—*Dej.* Canada E. and W. Common.

ELAPHRUS

RUSCARIUS—*Say.* Canada E. and W. Common.

CHLÆNIUS

SERICEUS—*Fost.* Canada E. and W. Common.
TRICOLOR—*Dej.* " "

CALATHUS

RUFICOLLIS—*Dej.* Toronto. Very rare.

ANCHOMENUS

EXTENSICOLLIS—*Say.* Toronto, Manitoulin. Common.

AGONUM

CUPRIPENNE—*Dej.* Canada E. and W. Common.
8-PUNCTATUM—*Fabr.* Toronto. "

ANISODACTYLUS

ELLIPTICUS—*Le Conte.* Canada E. and W. Common.

OCHTHEDROMUS

AMERICANUS—*Dej.* Toronto, Manitoulin.
TRANSVERSALIS—*Ibid.* "

NECROPHORUS

HALLII—*Kirby.* Canada W. Not uncommon.
VETUTINUS—*Fabr.* Canada E. and W. Common.

NECRODES

SURINAMENSIS—*Fabr.* Canada E. and W. Common.

OICEOPTOMA

MARGINATA—*Fabr.* Canada E. and W. Common.

THANATOPHILUS

CAUDATUS—*Say.* Canada E. and W. Common.

NECROPHILA

TERMINATA—*Kirby.* Canada W. Uncommon.

SILPHA

INÆQUALIS—*Fabr.* Canada E. and W. Common.

CATOGENUS

RUFUS—*Fabr.* Canada E. and W. Common.

DERMESTES

LARDARIUS—*Linn.* Everywhere. Common.

ONTHOPHAGUS

HECATE—*Pz. Fn. Am. Bor.* Canada E. and W. Common.

LUCANUS

DAMA—*Thumb.* Niagara. Common.

PASSALUS

(?) CORNUTUS—*Fabr.* Niagara. Common.

DORCUS

(?) PARALLELUS—*Say.* Canada E. and W. Common.

PELIDNOTA

PUNCTATA—*Linn.* Niagara. Common.

AREODA

LANIGERA—*Linn.* Messrs. Croft and Couper.

OMALOPLIA

SERICEA—*Illg.* Toronto. Common.

SERICA

VESPERTINA—*Schönh.* Toronto. Common.

OSMODERMA

EREMICOLA—*Knoch.* Manitoulin. Not common.
SCABER—*Beauv.* Canada E. and W. Common.

TRICHIUS

ROTUNDICOLLIS—*Kirby.* Canada E. and W. Common.

CETONIA

FULGIDA—*Fabr.* Toronto. Mr. Croft.

STENURUS

DIVARICATA—*Say.* Canada E. and W. Common.
(?) LURIDA—*Linn.* " Not uncommon.

CHALCOPHORA

VIRGINICA—*Drury.* Toronto. Mr. Couper.

CHRYSOBOTHRIS

DENTIPES—*Germ.* Canada E. and W. Common.

TRACHYPTERIS

FULVOGUTTATA—*Harris.* Toronto. Rare.

HEMICREPIDIUS

MEMNONIUS—*Hbst.* Toronto. Very common.

ALAUS

OCCULATUS—*Linn.* Canada E. and W. Common.

ELATER

LUGUBRIS—*Germ.* Canada E. and W. Common.
APICATUS—*Say.* Toronto. Mr. Couper.

CRYPTOPHYPNUS

DORSALIS—*Say.* Toronto. Common.
SILACEIPES—*Germ.*

LUDIUS

ABRUPTUS—*Say*. Manitoulin. Rare.

THANEROCLERUS

SANGUINEUS—*Say*. Canada E. and W. Not uncommon.

NECROBEIA

(?) VIOLACEUS—*F*. Canada E. and W., old bones. Com.

HYLURGUS

TEREBRANS—*Oliv*. Toronto. Common.
DENTATUS—*Say*. " "

ARRHENODES

SEPTENTRIONIS—*Hbst*. Toronto. Common.

PARANDRA

(?) BRUNNEA—*Fabr*. Canada E. and W. Common.

ORTHOSOMA

UNICOLOR—*Drury*. Canada E. and W. Common.

CHION?

(?) GARGANICUM—*Fabr*. Toronto. Very rare.

CRIOCEPHALUS

AGRESTIS—*Kirby*. Canada E. and W. Common.

CALLIDIUM

ANTENNATUM—*Newm*. Canada E. and W. Common.
VIOLACEUM—*Linn*. Montreal. Rare.

CLYTUS

* NOBILIS—*Harris*. Manitoulin. Rare.
SPECIOSUS—*Say*. Montreal. Not common.
FLEXUOSUS—*Fabr*. " "
ERYTHROCEPHALUS—*Oliv*. Canada E. and W. Common.

EUDERCES

PICIPES—*Fabr*. Toronto. Not uncommon.

GRAPHISURUS

(?) PUSILLUS—*Kirby*. Canada E. and W. Common.

MONOHAMMUS

TITILLATOR—*Fabr*. Canada E. and W. Common.
SCUTELLATUS—*Say*. " "

TETRAOPES

(?) TORNATOR—*Fabr*. Toronto. Mr. Couper.

COMPOSIDEA

TRIDENTATA—*Oliv*. Canada E. and W. Common.

SAPERDA

VESTITA—*Say*. Canada E. and W. Common.
PUNCTICOLLIS—*Ibid*. Montreal. Very rare.

OBEREA

3-PUNCTATA—*Fabr*. Canada W. Common.

DESMOCERUS

CYANEUS—*Fabr*. Toronto. Mr. Croft.

RHAGIUM

LINEATUM—*Oliv*. Montreal. Rare.

STRANGALIA

QUAGGA—*Germ*. Canada E. and W. Not plentiful.
FUGAX—*Fabr*. Toronto. Rare.

* Le Conte has informed me that my specimen is marked differently to any he has seen.

LEPTURA

SCALARIS—*Say*. Manitoulin. Rare.
CANADENSIS—*Oliv*. Canada E. and W. Common.
RUBRICA—*Say*. Manitoulin. Rare.

TRIGONARTHRIS

PROXIMA—*Say*. Manitoulin. Common.

LEMA

TRILINEATA—*Oliv*. Toronto. Common.

COPTOCYCLA.

A *new* species, not yet described or named.

GRAPTODERA

CHALYBEA—*Illig*. Canada E. and W. Common.

LABIDOMERA

3-MASCULATA—*Fabr*. Canada E. and W. Common.

CALLIGRAPHA

SCALARIS—*Le Conte*. Canada E. and W. Common.

GASTROPHYSA

CÆRULEIPENNIS—*Say*. Everywhere. Common.

CHRYSOCHUS

AURATUS—*Fabr*. Sault Ste. Marie. Not very common.

HIPPODAMIA

13-PUNCTATA—*Linn*. Canada E. and W. Common.
5-SIGNATA—*Kirby*. Canada W. "
PARENTHESIS—*Say*. Canada E. and W. "

COCCINELLA

BIPUNCTATA—*Linn*. Canada E. and W. Common.
12-MACULATA—*Gebler*. " "
TRANSVERSOGUTTATA—*Fald*. " "
9-NOTATA—*Herbst*. " "
SANGUINEA—*Linn*. " "

MYSIA

15-PUNCTATA—*Oliv*. Canada E. and W. Common.

EXOCHOMUS

(?) 4-PUNCTATA—*Motsch*. Montreal. Very rare.

TENEBRIO

MOLITOR—*Linn*. Canada E. and W. Common.

UPIS

CERAMBOIDES—*Linn*. Canada E. & W. Not uncommon.

BOLITOPHAGUS

CORNUTUS—*Pz*. Canada West. Common.

MELANDRYA

STRIATA—*Dej*. Canada E. and W. Common.

EPICAUTA

ATRATA—*Fabr*. Canada West. Common.

DENDROIDES

(?) CANADENSIS—*Latr*. Toronto. Male rare.

NOTOXUS

MONODON—*Hentz*. Canada E. and W. Common.

BOLITOBIUS

CINCTUS—*Giv. Micr*. Manitoulin. Rare.

STAPHYLINUS

VULPINUS—*Erich*. Canada E. and W. Common.
VILLOSUS—*Giv. Micr*. " "
CINGULATUS—*Grv. Micr*. Toronto. Not common.

(?) CHRYSOCEPHALUS—Toronto. Very rare.
EXULANS—*Erich.* Toronto. Mr. Couper.

CRYPTOBIUM

BICOLOR—*Giv. Micr.* Toronto. Not common.

PHÆDERUS

LITTORARIUS—*Giv. Mon.* Canada E. and W. Rare.

NOTES ON MR. COUPER'S DESCRIPTIONS,
Published at page 210 :

CICINDELA PURPUREA—I found more than common.
" PUNCTULATA—May be found pretty plentifully on the sandy road near Toronto Cemetery, about the middle of August.

AGONUM CUPRIPENNE—Larger than A. 8-*punctatum.*
" 8-PUNCTATUM—Common in damp situations.

OSMODERMA—I have found the O. *eremicola* always after sunset, but the O. *scaber* invariably in the day-time, and generally flying. Of the latter, those of Canada West greatly exceed in size those of Canada East.

NOTES ON PROF. CROFT'S ADDENDA.

CLYTUS ERYTHROCEPHALUS—Very common.
STRANGALIA FUGAX—Not uncommon.
CALLIDIUM *atennatum—antennatum ?*
LEPTURA CANADENSIS and PROXIMA—Not uncommon.

Reviews.

TRANSACTIONS OF THE LITERARY AND HISTORICAL SOCIETY OF QUEBEC, Part 3d, Vol. IV. :

1. *On the Twenty Years' Siege of Candia, by E. T. Fletcher, Esq.*
2. *Notes on the Resources and Capabilities of the Island of Anticosti, by A. R. Roche, Esq.*
3. *On the Water Power of Quebec ; and*
4. *On a Plan of the Construction of a Raft to Rescue Passengers from Sinkiug Ships, by Lieut. D. Ashe, R.N., F.R.A.S.*
5. *On the Mean Results of Meteorological Observations at Quebec, during the Winter of 1853-54, by Lieut. Noble, R.E.*

We hail with much satisfaction the appearance of the valuable little book, of which the foregoing heading gives the title and contents, as pleasing evidence of the continued, sure, though slow progress of a sister Association, in whose success the Canadian Institute must ever naturally take a lively interest; and we trust it will not be long before we shall have to welcome a fourth part, at least, to complete the Volume.

In characterizing the progress of the Historical Society as slow, we hope we shall be acquitted of any unkindly feeling, or desire to detract from its merits ; but when it is recollected that the first part of the same volume dates so far back as 1843, and the second did not appear till 1854, we think we shall be borne out in our observations,—particularly after the rather *unfriendly comparison,* lately made in a leading Quebec Journal, between its own local Association and the Canadian Institute. ur present object, however, is not to discuss the relative merits of either society, but to examine and comment on the contents of the welcome publication now before us.*

Of the first article, then, let us frankly observe that, however interesting the subject may prove to many, as a long bygone historical episode, perhaps a topic more apropos to the onward course of young *Canada* might have been selected by its writer ; but we willingly acknowledge having perused his pleasing narrative of the truly remarkable twenty years' siege of Candia, with considerable interest. Passing over, for the present, the valuable and timely Paper on the Island of Anticosti, we rejoice, even as *Torontonians,* to notice such, though minor, local articles as that of Lieut. Ashe on the Water Power of Quebec; and sincerely trust that the very commendable exertions of the citizens of "the Ancient Capital" to obtain an unfailing supply of so essential an element as pure water, have been crowned with triumphant results; and no one can help joining in the philanthropic desire that the ingenious plan proposed by the same intelligent writer, for the construction of a Raft for rescuing passengers from sinking vessels, may speedily be brought into successful practice. Of the valuable contributions of Lieut. Noble to the department of Meteorology, nothing need be said in this *Journal,* whose pages have so frequently been indebted to the same scientific observer.

We are now, therefore, left at liberty to retrace our steps, for the purpose of not only re-avowing our high estimation of

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*It may be proper to notice that the article alluded to, was the Editorial in the *Quebec Chronicle* of the 5th instant,—very naturally lauding highly its own local Society, but unnecessarily doing so at the expense of the Toronto Institute. The part to which we object is as follows :—" Comparisons have more than once been made between the L. and H. S. of Quebec, and the Institute of Toronto, to the detriment of the former. This, to say the least of it, is unjust, for if any one will take the trouble of looking into the publications of the two Societies, he will perceive that the articles of the Q. S., are *original,* and that those of the Toronto Institute, with very few exceptions, are copied from other works. Now, if the aim of such bodies be to give an impulse to studies, to develope abilities, as well as disseminate knowledge, our Society with less pretensions is unquestionably the better Institution. We cannot presume to say whether it was on this account that the T. I., received a Government grant this year of £850 in all, while the L. and H. S. obtained only £100." Now, with every wish to respect the opinions of the writer, we do not think that such observations in so influential a local Journal, arising either from neglect of information or reflection should be allowed to pass unnoticed, and we therefore take leave to point to the following indisputable facts, as giving a more correct view of the matter:—1st. Were the two Societies even to labour alike, it would not be quite fair to compare a hardy adult of thirty years, with a mere stripling, however stalwart, of four years growth. But, 2nd., it so happens, as regards the comparative proportion of fruits matured by the two associations, that though the Lit. and His. Society was instituted in 1824, the 1st volume of its Transactions (a moderate sized Octavo) did not make its appearance till 1829, and the 2d, in 1831; and that though the 4th part of the 3rd volume, came out in 1837, the 1st part of the 4th., or present volume was not issued till 1843, the 2nd., in March, 1854, after a long interval of 11 years, and the 3rd part only recently this year; and when the next will appear remains yet to be seen; thus yielding altogether four volumes, containing on a fair average from 100 to 120 original articles, in 31 years. Whereas, 3rd. the C. I., founded so late as 1851, has during the four short years of its existence, issued regularly during three of them a Monthly Quarto Journal in which, besides a variety of (avowedly intentional,) *miscellaneous* and *selected* matter, will be found scattered about 140 original articles of various discriptions, including the valuable monthly meteorological intelligence, which if bound up in the same form as the Transactions of the L. and H. S., would have furnished about *four* such volumes in as many years.

Mr. Roche's Essay on Anticosti, but of entering into considerable detail on the merits of the eminently patriotic views of the writer, by means of free progressive quotations from his valuable Remarks, in the confident hope of not only drawing public attention more generally towards an object of great public importance, but of happily, assisting in promoting the speedy peopling of the Island.

It is now near twenty years since the writer of this article, then on his way to England, was during a whole dreary tempestuous night in November, kept in no little *bodily fear* of of being either shipwrecked or worse, on the long proverbially dreaded desert coast of Anticosti; and had his attention and feelings ever since strongly enlisted in behalf of some ameliorations of its desolate state. It was, therefore, with no small satisfaction that he at once participated in the surprise expressed by Mr. Roche, that in the midst of the progress going on throughout British North America, in reclaiming the wilderness, and developing new sources of wealth, no account "had been taken of a valuable island, large enough to become a Province of itself, lying nearly in the centre of our North American colonies, and at the threshold of the most important colony of the whole; that while all is life and healthy activity about and beyond it, and a commerce, second hardly to the commerce of any one channel in the world, is carried past its shores, the seasons roll on without bringing to the latter any change in that state of desolation which invests it with frightful yet imaginary terrors, and which has done more to injure the reputation of the St. Lawrence navigation than all those real dangers upon the main shores of the river and gulf, where so many gallant vessels have been wrecked, and so many valuable lives have been destroyed."

Among the circumstances, (observes Mr. Roche) which have repelled all proper inquiry and all enterprise from Anticosti, and which have done much to injure the Province by giving a worse character to its great outlet than it really deserves, are former disasters from famine, which occurred there before provision posts were carefully kept up,* and the erroneous opinion which has hitherto prevailed, that a greater proportion of vessels have been wrecked upon the island than have been lost in any other part of the river or gulf. Thus the mariner has been taught to regard his approach to Anticosti with intense dread, the island having been described as presenting the greatest dangers to him when afloat, and as affording no sustenance for him if cast upon its shores.

But to those who have drawn conclusions unfavorable to the island, from the number of wrecks which have been reported to have taken place upon it, it is necessary to point out, that the wrecks, which in returns appear so formidable in the aggregate, under the head of "Anticosti," have not occurred at one spot, but at many spots widely separated, extending over a distance of 320 miles, that being the circumference of the island, and consequently the extent of coast in front, not taking into account the indentation caused by bays, creeks, &c. Take the same length of coast upon any part of the main shores of the river or gulf, and it will be found, upon proper inquiry, that six times as many wrecks have occurred within it each year, as have for the same period taken place upon Anticosti.

"And further, (observes our author,) the evil reputation which still hangs over the island, became attached to it many years ago, before its coasts were thoroughly surveyed, when it was laid down in the chart as being many miles shorter than it actually is, in consequence of which many vessels ran upon it in places where deep water was supposed to exist, and before lighthouses were placed there, since the erection of which and the late survey of its coasts, wrecks upon the island have become less frequent. Most of those which now occur there, are caused by the neglect of using the lead in foggy weather, many of them through the incapacity or drunkenness of masters, who, generally, are shamefully underpaid, and some of them through design, for the purpose of cheating the underwriters. Of these latter cases the Insurance officers are perfectly aware; but, instead of endeavoring to meet them by preventive measures, they increase the rates of insurance so as to cover such losses, by estimating for them in a certain proportion to the whole; thus making the entire trade pay for the dishonest acts of the rogue."

"At all events," it is justly remarked by Mr. Roche that, "to whatever extent plausible reasons may have once given a bad name to Anticosti, there is no just reason for that name being perpetuated; and those, who yet view the island as it was regarded shortly after the wreck of the Granicus, can neither comprehend the unjust grounds upon which it was then condemned, nor appreciate the importance to every country bordering upon the St. Lawrence, of many recent events, attending the rapid progress of the trade and general prosperity, which, with the exception of Anticosti, is going on in all parts of British North America. That the island should participate in that progress, it is necessary to divest it of the evil reputation through which it has been hitherto blighted: and this will be best accomplished by making known, in addition to what has been already advanced in its behalf, what it has yielded to the trifling labours of agriculture which have been attempted upon it, what its climate has been found to be by those who have resided there for many years, and what its natural resources and its important advantages of position really are.

"The island of Anticosti lies W.N.W. by E.S.E., between the 49th and 50th parallels of North latitude, and the 61st and 65th degrees of West longitude, about four hundred and twenty miles below Quebec, three parts of it being in the gulf, through which it stretches out towards the south-west coast of Newfoundland, and the remaining part in the river, the waters at the entrance of which it divides into two channels. It contains nearly two millions of acres, being upwards of one-fourth larger than Prince Edward's Island, which is a province of itself, with its Lieut. Governor, its legislature and a population of eighty thousand souls. It is about one hundred and thirty miles long and thirty-five broad in its widest parts, which is at the South West Point, nearly in the centre, whence it gradually narrows to both ends, the one terminating in Heath Point, with Fox Bay lying a few miles round the point upon its northern shore, and the other end terminating in West Point, with Ellis Bay a few miles short of it, looking towards the south. Thus there is a harbour upon each side and at each extremity of the island; but Ellis Bay is better situated for the general shipping of the St. Lawrence, has greater depth of water, and is much more spacious than the other, being about two miles wide and four deep, with good anchorage. The excellent position of the island in regard to ships, commerce, &c., becomes at once apparent, when we consider that every vessel must take either of the channels formed by Anticosti, upon entering or leaving the river, whether having passed from the Atlantic, or intending to pass to that ocean, through the Straits of Belleisle, now coming much into use, and about to be lighted, through the most frequented passage between Newfoundland and Cape Breton, or through the Gut of Canso, or whether running between Quebec and those portions of Canada, and of the Lower Provinces, lying upon the Gulf of St. Lawrence. In taking either of the channels formed by Anticosti, vessels pass close to the island, in consequence of the moderate breadth of the northern one, and of the strong south-east current which always runs along the southern channel, to avoid which, and the risk of being driven upon the truly dangerous coast of the south shore of the gulf and river, where, for several hundred miles, there is no harbour or place of shelter for any craft larger than a schooner, and where, for long distances, there is not one foot of beach outside the perpendicular cliffs to land upon, vessels generally stand out till they make the West Point of Anticosti, close to which is situated the convenient harbour of Ellis Bay, occupying a spot nearly mid-distance between the northern and southern banks of the St. Lawrence, and of easy access from both channels of the river. Considering that about two thousand vessels from Europe alone, will have made this point in the course of the present season, some slight idea may be conceived of the capabilities of position attached to the island, and in particular to Ellis Bay. The inner anchorage of this bay has a depth of from three to four fathoms at low water, with excellent holding ground, (gravel and mud), is of as large capacity as the harbour of Montreal, and has been found, by experience, to afford perfect shelter, in all winds, to vessels of upwards of 500 tons; while the outer portion of the anchorage could be materially improved at a trifling expense, so as to be able to contain in safety, during all winds, almost any number of vessels of the largest size. Docks, with a patent slip, &c., could also be constructed there, which would be admirably situated for the repair of vessels, stranded or receiving other damage throughout the St. Lawrence, most of them

* The sad wreck of the Granicus took place in 1828. Light-houses and provision stations were established in 1831.

becoming broken up by the action of the sea, and, in some cases, dismantled by wreckers, before they can obtain assistance from Quebec, which port, strange to say, is the only place from the Atlantic to Montreal, (a distance of upwards of eight hundred miles), where vessels can be properly overhauled, or be supplied with the commonest stores, such as anchors, chains, sails, &c. For steam tugs, employed for the relief of vessels in distress, Ellis Bay might also be made an excellent station. With the facilities there for procuring shelter for our shipping in a portion of the St. Lawrence, where a spacious and deep harbour is more wanted, than in any other part of the river or gulf, it is astonishing that no attention has yet been directed to that spot. This neglect, however, cannot long continue. It could be mado not only a fine commercial harbour, but also an excellent naval station, in the most convenient and central spot for commanding, with a few steam-vessels or gunboats, the two entrances of the river, aud for sending out cruisers up the latter, or to any part of the gulf.

Its influence as a check upon "wreckers," who swarm in the St. Lawrence more than is generally supposed, might also be enlarged upon.

Besides the advantages which have been glanced at as belonging to Ellis Bay, some of the best soil, and some natural meadows, producing excellent grasses, six feet high, are found upon its shores, where the resident in charge of the provision post, grows every description of vegetables; but wheat, or any other grain, has never been tried in that part of the island. It is also stated, that, within a few miles of the bay, wild hay could be cut sufficient to feed a thousand head of cattle during the winter. Nor is this spot barren in scenery; for, upon approaching it, a most pleasing view is obtained of the spacious bay, having in all parts a fine beach, which at each side is bounded by wooded cliffs, those on the east side showing table land and other heights beyond, and at the head of the bay the beach gently rises and expands into a slightly rolling country, containing forest and meadow land; the whole being relieved in the distance by two hills of moderate height, covered with trees. Near the centre of the bay, a few yards from the beach, stand the buildings, the garden and fields of the resident, close to a picturesque trout stream. When Anticosti shall be properly known and occupied, this spot will probably become the resort of many of those, who now seek health or recreation, at the less bracing and less interesting watering places upon the main shores of the river; and of the salubrity of the climate there can be no doubt, for all who have resided there, describe it as being the most healthy place in the world. The first seigneur, (to whom it was granted in 1680 for services rendered to the Crown of France), used to reside every summer upon the island, and it is supposed that he was buried there. At this spot there are many substantial elements for the growing up of a large and flourishing town, some of which are alluded to in other parts of this communication.

There is also excellent shelter for large schooners at Fox Bay, at the North-East end of the island, and also at the South West Point, where it is quite practicable to make a harbour of refuge for the largest ships; which would be of great use to homeward-bound vessels in the Autumn, whenever south-east winds set in, to run into and anchor, instead of being driven back for several hundred miles, and having to encounter again, under the worst circumstances, the most dangerous part of the whole navigation between the Atlantic and Quebec. There are also several good roadsteads, such as Bear Bay, situated on the north side of the island, sheltered from most winds, with good holding-ground. Observation River, lying five miles west of South West Point, has sometimes six feet of water at the entrance; and there is hardly a mile of coast on any part of the island without its stream of fresh and delicious water, many of them proceeding from lakes, one of which, at the head of Observation River, is supposed to be nearly twenty miles long and several broad. Some of the rivers have very high banks, with very beautiful falls, and excellent mill sites, and these falls have a good supply of water during the whole summer. The island on the south side generally rises from about twenty to sixty feet above the beach, (but at the entrance of Observation River it is between 200 and 300 feet high), and is nearly level to the centre, where a range of moderate sized hills appear to run its entire length, and upon the north side to terminate in steep cliffs. It is mostly covered with a thick forest of trees, stunted near the shore, (like those upon a great part of the coasts of England and of other countries), but which become gradually larger as they approach the interior, and are less exposed to the influence of the wind and sea. This is very remarkable upon some of the bays, where, at the exposed points, they are very small, and gradually increase in size from each side to the centre; those nearest the sea being some times quite white in appearance, from the salt which is thrown, and crystalizes upon them. It is the stunted growth of the wood upon the sea shore, which has given a coloring to the reports of those persons, who, having landed upon the beach for a few hours only, have pronounced judgment upon the whole island from what they saw there. The trees are spruce, fir, red and white birch, ash, quantities of very fine tamarack, and upon the north side of the island, some good sized pine. With the tamarack and pine growing there, and the immense quantities of valuable timber drifted upon the island from Quebec and other places after every easterly gale, many ships might be built every year. Like the valuable meadows for cattle and sheep, which have recently been discovered in Minnesota in the "Far West," there are here many very fine natural meadows, producing rich grasses, five or six feet high; and in some parts there are alternate ranges of wood and open plain. On the south side of the island there are several peat bogs of some extent, and some salt marshes, caused by the overflowing of the sea at certain periods, which must tend to fertilize rather than to impoverish the land, and, near the South West Point, there are some large salt ponds, which, were labor plentiful there, might be turned to account in the manufacture of salt; a manufacture which would become of some value to a great part of our North American fisheries, which, as well as the whole of Canada, are now supplied with salt from England or the United States, and, for curing fish and provisions, bay salt, formed from the sea and from salt ponds, is the most valuable. In consequence of there not having been a sufficient supply of salt upon the island, an immense quantity of fish, caught at Anticosti last year, had to be thrown away.

Of the other resources and capabilities of Anticosti, in the event of its being auspiciously settled, the following may be mentioned:—

Rearing of cattle and sheep, for the supply of those engaged in the fisheries, of shipping, and of the dear markets at Quebec, would, no doubt, pay very handsomely. While the natural grasses are as rich as any upon this continent, it appears that cattle can be left out to graze there longer than they can be at Quebec: a circumstance which has just been communicated to the writer by the present lessee of the island, who has at this moment several head of fine cattle of the Ayrshire breed, at the South West Point. But if the natural grasses should not be found sufficient for numerous herds of cattle, the famous tussac grass of the Falkland Islands, which delights in a salt atmosphere, and which has been carried to the Orkney Islands, and been found to flourish there, might be introduced. At the former it grows upon peat similar to that which exists at Anticosti. The seed of this grass has already become an article of profitable export from the Falkland Islands; and the grass is found upon many parts of the coast of South America, where wild cattle abound. When we consider that remote and inclement Iceland raises her flocks and herds, her sheep numbering 500,000, her horses 60,000, and her horned cattle 40,000, and exports the finest fleeces, also dairy and other produce, we have every reason to hope, that Anticosti, situated in the midst of the fisheries, which employ many thousand men, of a vast traffic, carried on by upwards of two thousand ships, and within easy approach of many valuable markets, may be made as profitable a grazing country as any portion of British North America.

At the South West Point, both Mr. Corbet, the lessee of the island, and Mr. Pope, the light-house keeper, have several head of cattle, as well as pigs and poultry, all of which are in excellent condition. Of the former, Mr. Corbet says, they look better in the spring than cattle do at that season at any place upon the St. Lawrence below Quebec.

Resting upon the substratum of limestone, the soil of Anticosti should be a warm one, and if cleared to any extent, and thereby exposed to the sun, and drained where it may require drainage, it would no doubt become a productive one. For the purpose, either of drainage or of irrigation, as the one or the other may be desirable, every facility is offered by the numerous rivers and rapid streams existing in all parts of the island. The composition of the cliffs alone, some of which, according to Capt. Bayfield, R. N., contain sand, clay and limestone, indicates that there must be good soil of considerable extent in many parts of the island, which only requires clearing and cultivation to yield very fairly; for, with these substances, and the fine mould of the vegetable deposits, which have been accumulating in the woods for ages, what better farming lands could be desired?

Of the interior of Anticosti, our Author observes, that Mr. Corbet, who has resided at the South West Point for ten years, and who, in his various excursions, has seen more of the island than any other person, describes the soil to consist generally of "black, light soil, clay and sand," and states that, "from the immense quantities of sea-weed with which the shores abound, he believes the land could be made to yield every description of farm produce. In the same statement he refers to what he and Mr. Pope have accomplished at the South West Point. The writer had, however, obtained a similar statement from the son of Mr. Pope last autumn. At this spot, which Lieut. Baddeley, R. E., who visited it in 1831, declared to be the most barren and uninviting in the whole island, Mr. Pope grew last year the finest crop of oats, 300 bushels of the best potatoes, (the potato disease never having reached the island), and every other vegetable in perfection which is grown in Canada; and this he did upon a patch of land adjoining the bleak point where the light-house stands, where the soil consists of a description of black peat resting upon the limestone. Mr. Pope supposes, though he has never tried it, that wheat might be successfully cultivated in the interior, which has never been explored beyond ten or twelve miles from the beach, along the banks of some of the rivers, and then generally by hunters or fishermen; parties not likely to look for or to care about agricultural resources. How much, therefore, must still remain to be explored in an island 130 miles long by nearly 40 broad! Of vegetables, also, Mr. Pope could have disposed of any quantity to ships bound to Quebec, which are often becalmed off South West Point after a month or six weeks' voyage, with a prospect of being nearly another month in reaching their destination. The supplying ships under these circumstances, especially when conveying cabin passengers and emigrants, may become a very profitable occupation to the settler. Vegetables, meat, fish, soft-bread, &c., could be easily taken off to vessels in boats, as they are at Portsmouth, Yarmouth, and a number of other ports in England, under circumstances far less favorable, by bum-boats, the owners of which realize immense profits.

Mr. Morrison, a person well known in Quebec, who (having been previously employed at Anticosti by the North West Company,) was sent there about fifty years since, to explore a portion of the island for the purpose of forming a settlement, after mentioning in his report the excellency of the soil, and the timber which he found there, including ash, large pine and tamarack, says: "I had a house erected on the south side of the island, around which we made a clearance, and sowed wheat, barley, and oats, all of which grew luxuriantly and ripened. Vegetables and garden stuffs of every description grew remarkably well, and came to as great perfection as any I have seen in Canada. There is very good clay on the island, of which I made some bricks, and built an oven, and whilst thero I imported some cattle from Nova Scotia, and found that they throve well." Why the explorations and labors of Mr. Morrison led to no result at that time, is thus explained in his statement, made in 1842, to the present proprietors of the island: "After I returned to Quebec and made my report, Mr. Grant, tho then proprietor of the largest portion of Anticosti, at once came to tho determination of settling it, and offered to me the superintendence. During tho winter of 1804, I engaged by his directions eighteen men, intending to proceed with them to Anticosti in the spring, and to immediately set about cutting a road across the island; but, unfortunately, Mr. Grant died about that time, and the intention which had been entertained of colonizing tho island was abandoned, a circumstance much to be regretted."

Copious as our extracts have already been, we regard the subject and its object of such great importance and general interest, that we offer no apology for adding the following in as condensed a form as possible:

While all parties consulted generally agree as to the timber, and the nature of the soil, they also represent the climate to be milder than at Quebec; and as regards the degree of heat and cold, much like that of Newfoundland, but not so subject to fogs; and that the navigation is open for about six weeks longer than at Quebec; and further, that it is probable that, with properly constructed and manned steamboats, or the boats so favourably spoken of by Polar navigators, a communication between the south-west point of the Island and the south shore of the St. Lawrence, might occasionally be kept open during the whole winter, the ice never extending across, or blocking up the whole of the channel.

We now pass on to notice, with Mr. Roche, those resources belonging to Anticosti, which, being wholly independent of soil and climate, may be turned to immediate account. These principally consist of its sea and river fisheries, which, although comparatively neglected by Canada, may be classed among the most valuable fisheries of British North America.

In the recent report, published by the New Brunswick Government upon the fisheries of that province, mention is made of the valuable whale and cod fisheries existing upon the coast of Anticosti; and it is stated that the Jersey houses fit out vessels to carry on the former upon both sides of the island, and up the St. Lawrence as far as Bic, some of of the whales, ("hump backs"), being seventy feet long, and yielding eight tons of oil; while the fishermen of Gaspé frequently resort to the east end of the island and take cod in great abundance.

It thus appears that on every side of Anticosti valuable whales abound; the pursuit of which, and of seals and cod, it is not improbable, could be carried on in winter as well as in summer, were the attempt to be properly made.

Of cod, (observes Mr. Roche), Mr. Corbet remarks that "one boat, with two good fishermen, could take off South West Point, or at Fox Bay, eighteen hundred of these fish in one day;" while Mr. Morrison stated that cod, halibut, and a variety of other fish, could be caught all round the island in incalculable quantities, and that no finer cod is caught on any part of the coast of America, or on the banks of Newfoundland, than is to be met with there. To this may be added the testimony of Capt. Fair, R.N., of H. M. ship Champion, who states that he met a few shallops from the Magdalen Islands, at the east end of Anticosti, where they found cod in great abundance, and of excellent quality.

Of hardly less value than the former is the seal fishery, which could certainly be carried on in winter, as well as in summer, many seals being seen on the ice during the former season and in the spring, and thousands of them being observed during the summer and autumn, at the entrance of all the bays and rivers, where they remain almost entirely unmolested. To show the value of this fishery in the gulf, the New Brunswick official report, already cited, brings forward an instance of a schooner engaged in it from Sydney, Cape Breton, having cleared £14,000, within three weeks of her having left that port. Yet at Anticosti, where seals abound more than in most parts of the gulf, this fishery is at present almost entirely neglected; the Americans and others, who resort to its neighbourhood, being principally engrossed with the still more profitable cod and mackerel fisheries. For the storing and preservation of seal, whale and cod oil, the temperato degree of heat at Anticosti during the summer, is particularly favorable.

At the present moment the mackerel fishery is the most lucrative one in the St. Lawrence, and is the most extensively pursued; mackerel now selling at Boston for nineteen dollars a barrel, and at Halifax and Quebec for a few dollars less than that sum. No part of the gulf abounds with this fish more than the neighbourhood of Anticosti. Many schooners visit the coasts of the latter from the United States, the Lower Provinces, and a few from Gaspé, to carry on this fishery, in which they are very successful; and Mr. Corbet states that the mackerel he has seen in July and August come in shoals so thick and so close to the shore, that as many as one hundred barrels could be taken in one haul of the net. A few hours' work will thus sometimes pay the whole expenses of a schooner during the season.

Herrings, as fine as any in the world, are as plentiful about the island as mackerel; but, from the wretched manner in which they are cured, they obtain a much less price in the market, and are, therefore, comparatively neglected by the fishermen.

At the entrances of all the rivers and creeks immense quantities of lobsters are thrown up by the sea; the collection of which, and the preserving them on the spot for distant markets, or sending them fresh in vessels containing wells, to our home markets, might render this fishery a very profitable one. Eels are also very numerous and very fine, and are often collected by parties of Indians, who come over for the purpose from Mingan, and who obtain a high price for them from the Americans. Some of the halibut, which are found off the coast, attain the weight of three or four hundred pounds.

The caplin, which are now merely used as bait for cod, are so abundant around the island, that they are some times thrown up by the sea and cover the shore to the depth of two feet. Were they pro-

perly cured and exported, they would find good markets in Europe; or oil of an excellent quality could be made from them by the simple process of boiling.

The number of schooners which resort to the shores of Anticosti, from the United States, the Lower Provinces and the Magdalen Islands, in pursuit of the cod and mackerel, is so great, that there are sometimes as many as one hundred vessels fishing between the East Point and Fox Bay at one time, all of which are generally very successful. If these fisheries can be so profitable to expensively fitted out schooners, (of from 40 to 150 tons), some of which come a distance of fifteen hundred miles, and have to bring every supply, including provisions and salt, with them, how much more profitable would they become to parties residing upon the island, who would have their supplies upon the spot, and who could carry on their operations in boats. How important also to the latter, would become the trade which might be created with the former: the supplying them with provisions, often with fishing gear, and with every description of marine stores; and how soon would such a trade lead to more extensive transactions, in regard to the purchase of fish upon the spot, and the disposal of it in the best markets, and to a further trade in West India, South American and Mediterranean produce, obtained in exchange for fish, and being in great demand in Canada. It might also lead to the gradual rise, at different points of the island, of good sized villages, and ultimately of towns.

Of the river and lake fisheries of Anticosti, Mr. Corbet, who leases them, as well as the right of hunting the whole island, but who keeps up a very small establishment, and consequently makes use of his privilege to a very slight extent, says: "I have frequently, along with two Indians, taken in the month of July, in one day, twelve hundred salmon-trout, and upwards of two hundred salmon, out of Observation River, near the South West Point, the majority of the salmon-trout weighing four pounds, and the salmon from twelve to fifteen pounds;" and Mr. Morrison states, that the first day he went up Salmon River he caught, in a very short time, with a small net, from two hundred to three hundred fine salmon; and that, too, by confining his fishing to only two or three of the numerous holes to which salmon resort in that river. Even in winter Mr. Corbet has caught quanties of fine trout, by cutting a hole in the ice, and fishing with a hook. This gentleman owns a schooner, in which he sends the produce of the fisheries, and of the chase, obtained by him, to the Quebec market, where it commands a high price. The master of this schooner is one of the many parties, who are desirous of purchasing land, and settling entirely upon the island, with which he has been connected for fifteen years.

Though all the rivers of Anticosti abound with the finest salmon, few of them are fished to any extent, in consequence of there being but a small number of persons residing upon this island, and those who come there not being prepared, and not having the right to fish in the rivers; which, with sufficient attention and judicious management, might be made almost as valuable as the best salmon rivers in Scotland, for each of which a rent is obtained of from five to fifteen thousand pounds sterling, per annum. The markets for fish in the United States, being about to be thrown open to Canada, under the Reciprocity Treaty, will soon become quite as remunerative as any in Europe, and will consequently raise the value of our river fisheries to what is obtained for the most valuable of the former.

The porpoise fishery, which is successfully conducted at Tadousac, at the entrance of the Saguenay, each porpoise caught being worth £25, in the leather and oil which it is made to yield, might also be carried on at Anticosti at a considerable profit, the latter being as well situated for the purpose as the former.

The hunting upon the island is of considerable value, though of far less importance than its fisheries. The animals consist of black bears, martins, otters, and the silver gray, the red, the black, and sometimes the white fox; all of which are very numerous, and for the skins of which Mr. Corbert realizes excellent prices in the Quebec market.

Great quantities of ducks, geese, partridges, and other fowl, also resort to the lakes upon the island, some of which are of a species peculiar to England; and a duck, called the *muniack*, remains about the shore all the winter.

Thus, even in respect to food, Anticosti, in an uncultivated state, is not so inhospitable as it is generally supposed to be; for with its fish, its bears' flesh and its fowl in abundance, what active sportsman is there, who could not often obtain a meal there, with his rod, or with his gun?

With so many other resources, it is of little consequence whether or not Anticosti shall be found to possess valuable minerals. There is no account of its having been visited by a geologist; but iron ore of great richness, is frequently met with.

Mr. M'Ewan mentions having found freestone, some as also as fine as water of Ayr-stone, and some as coarse as grindstone. The fossiliferous limestone, which exists in great quantities upon the shores in thick horizontal strata, is of so fine a grain and color, and so hard, that it is deservedly classed under the head of marble.

Taken separately, observes Mr. Roche, the resources of Anticosti, as they are yet known, may not appear so important as those of countries more favored by careful attention, by settlement, and by a fair expenditure upon them of labor and science combined, under which their resources have been partially developed; but, viewed together, they cannot but be regarded, by any unprejudiced observer, as of considerable value, and as giving promise, (upon the introduction there of those agencies which have been successfully at work elsewhere), of becoming a source of wealth and prosperity to the whole province. No comprehensive view of the resources and capabilities of the island having ever been taken, is one reason why it has been so long neglected; and why, throughout its three thousand three hundred square miles of territory, it yet gives shelter to no more than some fifteen or twenty residents, distributed between the fishing stations of the lessee, the light-houses and the provision posts, all of which are situated upon the south side of the island; the fishing stations being at the South West Point and the entrances of Observation and *Becscie* Rivers, the light-houses at the East Point and the South West Point, and the provision posts being also at the light-house stations, at Shallop Creek, about half way between them, and at Ellis Bay. The state of desolation in which the island remains, is shown by the necessity for keeping up these provision posts for shipwrecked sailors, in the same manner as, in former days, wells were dug, shady trees planted, and caravansaries maintained in the desert, for the relief of pilgrims and travellers by the Arab and Indian princes; but, unlike the deserts of the East, Anticosti has hitherto been condemned to desolation, not on account of its being incapable of being made to sustain a population, but because of the superficial examinations of its soil, bordering upon the sea shore only, which have been made from time to time, and of the reports and general rumours, based upon those examinations, similar to those unjust popular rumours, which have for many years kept back many other countries, since become known and now arrived at a flourishing condition, and which, until the last few years, condemned Newfoundland to be a mere fishing station. Even Prince Edward's Island, now the garden of our maritime provinces, was for a long period kept back by prejudices, as absurd and unjust, as those which long operated against the progress of Nova Scotia and Newfoundland, and which up to the present time, have rendered Anticosti worse than useless; a terror to the mariner, and an inhospitable wilderness at the threshold of the province, frowning upon, and depressing in spirit, all who seek Canada by the route of the St. Lawrence.

But what Mr. Roche conceives to give more value to Anticosti, than its capabilities of soil and climate, or its many other resources, whether belonging to the sea, to the rivers, or to the land, is its position at the entrance of the St. Lawrence, in the direct and only channel of an immense traffic, which, within a very short period, is certain to become vastly increased, not only by the throwing open to the Americans the navigation of the St. Lawrence, under the reciprocity treaty, recently concluded, but also by the extension of the trade of the Province to all parts of the world.

"Whether viewed with regard to this future trade, or to the existing maritime trade of the Province, which is confined to England, the United States, the Lower Provinces, and the West Indies; to the establishment of an *entrepot* in the direct channel of that trade, and of a coaling station for the three lines of steamships about to run between England and Quebec; or viewed as affording the most favourable points for establishing fishing stations, and of settlements and villages for supplying the fishermen belonging to the island, as well as those who will be attracted to its coast fisheries from a distance, and who will be desirous to rent certain portions of the shore for the purpose of drying fish there; the position of Anticosti is a most admirable one; and if the island were composed of nothing but rock, without soil sufficient to produce a blade of grass, its position

alone would render it capable of being made of more value than the most favoured island in point of soil and climate, not possessing the advantages of that position."

Our nearly exhausted space will only permit us to add to the above copious quotations, an hearty assent to Mr. Roche's conviction that, besides participating in the main trade of the Province through Quebec, the neighbouring rising settlements up the Saguenay, towards Lake St. John, might be made to contribute to the importance of Anticosti, and that it might even become an emporium of a portion of the commerce which Canada is now in a position to open with all parts of the world; for to large vessels coming late in the season off long voyages from the West Indies, China, &c., it might frequently be of consequence to avoid the delays and dangers attending going up the St. Lawrence.

Mr. Roche winds up the main position of his interesting and instructive Paper, by stating that after recording all the information received from others, he seized an opportunity of visiting the Island himself, and, in addition to his own personal observations, making enquiries into its present position from nearly every person residing on it; and that the results fully confirmed all that he had written; but to these we are unable to refer; and he concludes with strenuously recommending the settlement of the Island to be undertaken by a *Joint Stock Company*, if encouraged by a preliminary Survey of it by the Government—very properly observing that notwithstanding all that he had learnt, it was very evident that "not one-tenth of the Island has ever been explored, or even traversed; the hunters and fishermen, and others who have been upon it, having confined their excursions to the sea-shore and the principal rivers, hardly ever venturing any distance back from the latter. Like all countries, Anticosti must contain much bad land as well as good, and the former might be supposed to prevail along the shore, where, in some parts, there are quaking bogs, like those of Ireland (which, however, may be drained and be turned into the richest soil), and a good deal of rock; but, whether the good or the bad land predominate to any extent throughout the Island, there can be no means of ascertaining, without a thorough survey of the interior. That much good land, besides those fertile spots which have been pointed out by the various parties referred to, is likely to be discovered by such a survey, the writer is now enabled to show, upon one of the highest authorities existing upon this continent, namely, that of Professor J. Hall, Palæontologist of the New York State Geological Survey, and author of the *Palæontology of New York*, who, having examined a number of fossils brought from Anticosti, described them as indicating the occurrence of limestone beds, with alternations of shale, the decomposition of which will furnish a productive soil, from abounding in calcareous matter; an opinion coincided in by our talented Geologist, Mr. Logan, in addition to his expressing a strong belief that a regular Geological Survey of the Island was likely to lead to discoveries which would give to it an increased economic value; a specimen of its marble having obtained the first prize at the recent Provincial Exhibition at Quebec.

In this very judicious suggestion we cordially concur; as not only the most feasible, but also likely to be the most speedy as well as most successful mode of carrying out an enterprise which, we have long been persuaded, will prove of incalculable benefit to the country, and be certain of, in a few years, transforming the long-dreaded, desolate shores of Anticosti into a cheerful view of cultivated farms and thriving villages, sprinkled round well-frequented harbours and profitable fishing stations.

We now bring our lengthened quotations and remarks to a close, with thankful acknowledgments to the talented author for having directed public attention to a new, promising and extensive field for various kinds of industry, and not without a hope that the considerate suggestions contained in the few following lines may be speedily acted upon :—

"As Anticosti belongs to a number of persons, some of them residing in Canada, and others in England, who are not likely to combine in any comprehensive plan for developing its resources, but who would no doubt be prepared to dispose of their interest in it at a reasonable price, it is to be desired, that either the Government, or some public company in Canada or England, or one belonging to both countries, should purchase the island, and expend sufficient means, which the present proprietors could not afford, in turning its resources into account. Of the two, a company, which could enter into the several undertakings glanced at in this communication, would be the more suitable for the purpose; but the field may be made to embrace so many, and such varied objects, that it could well give employment to several distinct companies. There might then be a colonization company, a fishing company, and a commercial company: the first purchasing the whole island, and selling or leasing to the others, those portions of the coast at which the operations of the latter could be most conveniently carried on. A thorough survey, however, of the whole island might be well undertaken by the Government in the meantime; for, although it belongs to private individuals, it is of the highest public importance, for many reasons, which must suggest themselves in the course of this communication, that the island should not be allowed to continue in its present state of desolation; besides which, every large addition made to the inhabited seaboard of the St. Lawrence, must materially increase the commerce, the shipping, and the wealth of the Province."

Direct Nature-Printing from Wood,

IN AN ENDLESS WAY, APPLIED TO THE DECORATIVE ARTS.

BY FELIX ABATE, OF NAPLES.

In the first communication I had the honour to make to the Society of Arts* on this invention, I described two different processes which I employ for the purpose; the one of them depending upon the effects produced by the joint action of acids and heat upon vegetable substances; and the other, a more complex one, as it comprises the different processes upon which the art of dyeing and printing textile materials rests. Both these processes, by different means, produce nearly indentical results.

In order to bring my invention to practical utility, and make it serve the various purposes of the decorative arts to which it may be applied, I thought it was requisite that the nature-prints should be made in an endless way, as is done for woven stuffs, which, being an essential point for the application of the invention to house decoration, is undoubtedly the most suitable way to obtain that cheapness of manufacture which is the first condition for the general adoption and success of every new invention. I had then to choose between the two above-mentioned processes to which of them I should give the preference, and I found the second one to be in many respects superior to the other.

A machine, constructed upon the principle of the cylinder printing-machine, was then requisite for my purpose, in which the printing cylinder should be made, either solid or veneered, of the wood from which impressions are intended to be taken. However, this contrivance, which in the last quarter of a century has brought such important results in the art of printing textile manufactures, could not be applied to the above purpose without meeting with peculiar difficulties, against which, in fact, I had long to contend. The most serious of these difficulties

* See Journal of the Society of Arts, Vol. ii., p. 539.

were two—the one was, in contriving a self-acting apparatus for feeding the cylinder with the requisite fluid, at such a constant and controllable degree as experience has found suitable in the printing with flat blocks by manual labour; the other was in the discovery of some new means to dispense with the bathing of the printed stuff either in a mordant or in a colouring bath, whenever paper is the stuff to be printed on; as unsized paper, which is the most suitable for the purpose, will not bear, in a wet state, being drawn through the machine. Besides, it was desirable that the different successive operations which are performed in printing textile manufactures should be done at one time and in a single revolution of the machine, in order to reduce the cost of manufacture to its minimum.

I have made the cylinder-feeding apparatus in the shape of a trough, in which the wetting fluid is kept at a constant level through a reservoir from above and a discharge from below. A cloth, one side of which is immersed in the liquid, acts by capillary attraction as a syphon, and communicates the liquid in a continuous supply to to the revolving cylinder with which it is in contact from the other side—an elastic cushion placed between the trough and the cloth securing the requisite equality of pressure of the latter upon the cylinder, while a pair of screws pressing on the back of the trough serve to regulate at will the degree of such pressure. This apparatus answers the purpose perfectly well.

In order to dispense with the bathing of the printed stuff, I had recourse to the metallic sulphurets, which are known to produce more lasting colours than the vegetable dyeing stuffs. Therefore I contrived to obtain the required effects by using for the printing menstrum any of those metallic salts, such as copper, iron, &c., which by the action of hydrosulphuretted acid or alkalies are precipitated in the state of metallic coloured sulphurets; I use such reagents in the gaseous form, such as hydrosulphuretted ammoniacal gas. The printed stuff is made to pass direct from the cylinder after it is printed, through a box, which is kept constantly supplied with a current of gas; it comes out of the box completely finished; then, passing through a stove kept at a moderate heat, dries—and lastly winds itself round a reel, ready for sale. In this way the thorough printing of the stuff in a single revolution of the machine is performed.

The principle of using the hydrosulphurets in the gaseous state in the art of dyeing, which, as far as my knowledge goes, has never been done before, is of considerable importance in that branch of manufacture, as it produces the most satisfactory results with the greatest convenience and cheapness, while it entirely obviates the evil arising from the noxious evaporations of the hydrosulphurets when used in the liquid state and left to evaporate in the open air.

On Hydraulic Limes,

ARTIFICIAL STONES, AND DIFFERENT NOVEL APPLICATIONS OF SOLUBLE ALKALINE SILICATES.

BY M. FR. KUHLMAN.*

Entrusted, about the close of the year 1840, with some trials relative to some abundant efflorescence, which was formed on a perfectly new building, and which was considered to be due to the formation of nitre, I was soon convinced that the efflorescent salts were formed to a great extent of carbonate of soda, and that the lime which had been used (hydraulic lime, from the neighbourhood of Tournay), was the cause of the efflorescence which had been observed. A closer examination soon taught me that all limes, and particularly hydraulic limes and natural cements, contained appreciable quantities of potash and soda.

* Cosmos.

THEORY OF HYDRAULIC LIMES.

In a work which I had the honour of presenting to the Academy, at a meeting held on the 5th of May, 1841, I endeavoured to explain the part which potash and soda might play in stones and cements, and I admitted that these alkalies served to bring the silica to the lime, and thus to form silicates, which, by means of the application of water, solidified a portion of the mass, producing the formation of a hydrate, analagous to that which takes place with plaster. I have pointed out since then to the Academy numerous facts as the basis of this theory, and that, among others, of the immediate change from fat lime to hydraulic lime, by simply treating with a solution of silicate of potash. If, after the burning of the limestone, potash is in contact with silica, the silicate which is formed must necessarily react, and this can only take place as soon as the burnt lime is brought into contact with water.

I have greatly added to my experiments on this head, and I have established the fact that, with fat lime and silicate of potash, both of them pulverised and mixed in the proportion of 10 or 12 of silicate to 100 of lime, a lime can be obtained which shall have all the characteristics of hydraulic lime. If these substances are not well pulverised the reaction will be very incomplete, and an effect will subsequently be produced, bringing on disintegration. If from my former trials there results the possibility of converting a fat lime into an hydraulic mortar, by sprinkling it with a solution of an alkaline silicate, in my more recent trials I have found a means of producing at once with a vitreous silicate and lime, hydraulic cements of any required degree of strength. This will enable us to form, at a reasonable expense, buildings to stand the action of water, in places where fat limes alone are now found. Powdered silicate of potash in some sort becomes an agent for producing this hydraulic property, of which future experience will determine the value.

ARTIFICIAL STONES.

Looking at the great affinity of lime for silica dissolved in potash, I was naturally led to examine the action of alkaline silicates on calcareous stones. Here I was still more fortunate, for the alkaline silicates became at once the means of a variety of applications of the highest utility. Let us look at what is said on this point in the *Comptes Rendus* of the Society's meetings.

"By mixing some powdered chalk in a solution of silicate of potash, a cement is obtained, which hardens slowly in the air, assuming a degree of stiffness, which, under certain circumstances, renders it applicable for the restoration of public monuments and the manufacture of moulded articles.

"Chalk, whether in an artificial paste or in its natural state, plunged into a solution of silicate of potash, takes up, even when cold, a quantity of silica, which may be increased considerably by exposing the chalk alternately to the action of the siliceous solution and the air. The chalk assumes a smooth appearance, a compact grain, and a colour more or less yellow, according as it is more or less impregnated with iron.

"Stone thus prepared is susceptible of a high polish. The hardness, which is at first but superficial, penetrates by degrees into the centre, even where there is considerable thickness. It appears capable of becoming of incontestible utility in the form-

ation of works of sculpture, and ornaments of the most delicate workmanship; for when the silicifying process—"*silicatisation*"—has been effected on well-dried chalk, without which good results are not possible, the surface remains unalterable.

"Some attempts made to render this stone applicable for lithography give promise of great success.

"This method of converting soft limestone into siliceous limestone is likely to become a great acquisition in the art of building. Ornaments, unaffected by damp, and of great hardness, may thus be obtained at little cost; and, in many cases, a plaster made with a solution of silicate of potash will preserve from subsequent decay ancient monuments formed of soft limestone. This same plaster may become of general application in those countries where, as in Champagne, chalk forms almost the only building material."

I have shown experimentally that one part of the silica from the silicate becomes separated by the action of the carbonic acid of the air, but that those parts of the silicate which have come into contact with a sufficient quantity of carbonate of lime, pass into the state of silicate of lime. My work, presented to the Academy in 1841, pointed out numerous industrial purposes to which the impregnating of porous bodies of mineral substances might be applied, whether the objects operated upon were organic or inorganic. Considering these applications of the art as of the first importance in building, I have attempted to extend them, and I have just laid before the Academy a new series of observations.

HARMONIZING THE SHADES OF THE SILICIFIED STONE.

I have given the name of "*silicatisation*" to this remarkable conversion of soft and porous limestone into siliceous and compact limestone. As the operation of this process to articles of sculpture and building materials gives rise to a colouring very frequently so marked as to render the joinings more apparent and the veins more distinct, I have been compelled to seek a remedy for this objection.

There are two essential and general points to be met. Chalk walls are too white, while some kinds of ferruginous limestones are too sombre in their shades. To obviate this inconvenience, I perform the *silicatisation* of limestones which are too white with a double silicate of potash and magnesia. This is a vitreous substance, which forms a brown solution, and which when used in the process causes a little oxide of manganese to be deposited in the artificial siliceous paste. Oxide of cobalt, too, will combine, though in very small quantities, with silicate of potash. Silica precipitated by a current of carbonic acid is of a brilliant azure blue. This silicate may be used in the treatment of white marbles.

When the shades of the stone are too decided, and that is the most common defect, I obtain good results by mixing in the silicate solution a small quantity of artificial sulphate of barytes, which in penetrating the porous stone, whilst it forms a layer of silica, remains fixed, entering, as we shall see below, into a state of chemical combination. As regards the joints, they may be made with common cements, the shades of which may be rendered lighter by means of some white substances, but they may be still more entirely concealed with broken pieces of the stone itself mixed with silicate of potash, the whole being well pulverised previous to its use, and applied in a state of liquid paste.

COLOURING THE STONE.

In the course of my researches for giving to these silicified stones shades which would cause those portions of our buildings which had been submitted to this process to harmonise with those which had not, I was led to submit the stones to an actual dyeing process by impregnating them in the first instance with certain metallic salts, which by precipitation would produce the required colour.

Thus, impregnating the stone with salts of lead or copper, and afterwards bringing it into contact with sulphuretted hydrogen gas, or a solution of hydrosulphuret of ammonia, I obtain at will grey, black, or brown shades; with salt of copper and ferrocyanide of potassium I get shades of copper colour, &c.

In the present case I have made an observation which in a chemical point of view is not devoid of interest.

I have stated that the porous limestones, when submitted at a boiling heat to solutions of metallic sulphates whose bases are insoluble in water, give rise during the whole reaction, to a disengagement of carbonic acid, and to the fixing in sufficient depths metallic oxides in intimate combination with sulphate of lime. When the metallic sulphates have a coloured base, very beautiful tints of different and perfect shades are obtained. Thus, with sulphate of iron we get the production of a tint in red rust, more or less deep according as we operate with solutions of green vitriol more or less concentrated; with sulphate of copper the stone takes a magnificent green tint; with sulphate of manganese brown shades are obtained; with a mixture of sulphate of iron and sulphate of copper we get a chocolate colour. I have also experimented with sulphates of nickel, chromium, cobalt, &c., and with mixtures of these sulphates.

The affinities which determine the reactions in question are sufficiently powerful to cause the metallic oxides to be completely absorbed by the stone, so much so, that certain oxides, such as that of copper, for instance, entirely disappear from the solutions after boiling with an excess of chalk.

It is remarkable, that when in operating with mixtures of salts of copper and salts of iron or of manganese, the oxides of iron and manganese are the first to be thrown down.

When we operate with sulphates having a colourless base, such as sulphate of zinc, magnesia, or alumina, we equally obtain the precipitation from the oxide, and their penetration to a certain depth in the stone, with a disengagement of carbonic acid.

The bi-sulphate of lime gives analagous results.

In general, when we intend to use coloured stones in buildings, &c., or to form mosaics, it will be found useful to increase their hardness by the silicifying process.

We may proceed in the same way with articles in shell, white coral, &c., in which the colour may be produced by the same process, acting at different pressures.

I will conclude this head with an important observation, which is, that the double sulphates which are formed in penetrating the stone, make a body with it, and increase its hardness to such an extent, that when certain sulphates are employed, such as that of zinc, the silicifying process becomes unnecessary.

The editor of "Cosmos" adds, the process which has just been described, is likely to tend to the production of a great and new industry, splendid specimens of which are to be found in the Exposition Universelle, placed in the central gallery of the "Annexe," on the banks of the river, opposite the produce from the mines of Anzin. We shall examine these specimens with care, and give a detailed account of them when we treat of the section of the chemical arts. The display made by the celebrated chemist of Lille is one which deserves great attention.

The Arctic Expeditions.

The Select Committee appointed to inquire into the circumstances of the Expedition to the Arctic Seas, commanded by Captain M'Clure, of the Royal Navy, with a view to ascertain whether any and what reward may be due for the services rendered on that occasion, and who were further instructed to examine into the claims of Captains Collinson and Kellett, with a view to ascertain whether any and what reward may be due to them for the services rendered on the occasion of that expedition; having examined some of the most distinguished explorers of the Arctic regions, including those who were ordered to relieve or ascertain the fate of the lamented Sir John Franklin; having also had before them the evidence of others well acquainted with the Polar Seas, and also the report and evidence of Captain M'Clure, have considered the other matters to them referred, and agreed to a report of which the following paragraphs are the most interesting and important:—

"The attempt to discover a water communication through the Arctic Regions between the Pacific and Atlantic Oceans is one which has engaged the attention of maritime nations, and especially that of Great Britain, for a period now extending over nearly three centuries. It has fallen to the lot of Captain M'Clure, his officers and crew, to set at rest this question. They are undoubtedly the first who have passed by water from sea to sea, and have returned to this country a living evidence of the existence of a north-west passage.

"On the 30th July, 1850, the Investigator parted company from Her Majesty's ship Herald, Captain Kellett, off Cape Lisburne, and stood to the northward until the morning of the 2d of August, when the ice was first fallen in with, in lat. 72° 1′, long. 166° 12′ W. Captain M'Clure worked along its edge until midnight of the 5th, when Point Barrow was rounded in open water; from this point his progress was beset with difficulties and anxieties of no ordinary character, having to traverse an ice-encumbered sea hitherto considered impracticable for navigation. In this sea the Investigator continued her course along the north coast of America, and on the 30th of August reached Cape Bathurst, having in the interval threaded her course amid sandbanks and heavy masses of ice, a great portion of that time enveloped in thick fog, where the lead was the only guide.

"Here, finding that the ice pressed upon the shore, barring any further advance, Captain M'Clure anchored till the 1st of September, when the ice slightly moving enabled him to round the Cape, crossing Franklin Bay, and on the morning of the 6th high land was observable to the N.E., and on the 7th Captain M'Clure landed on its southern extremity, taking possession, in the name of Her Most Gracious Majesty, with the usual ceremonies, naming it Baring's Land, after the First Lord of the Admiralty. Proceeding to the N.E., through continuous fogs, until the morning of the 9th, when it clearing a little, high land was remarked, to which he gave the name of Prince Albert; and on the 10th two small islands were passed, which were called after her Royal Highness the Princess Royal; the further advance of the Investigator was then impeded by ice setting in from the N.E., which beset her, and in which she drifted about the straits in great peril, attached to a small piece of ice, drawing eight fathoms of water, until the 30th of Sept., when she was firmly frozen in. Captain M'Clure, entertaining a strong impression that the waters in which the Investigator then lay communicated with those of Barrow's Strait, and that the important question of a north-west passage might now be solved, set out with a sledge and a few men on the 21st of October for the purpose of testing this conviction, having previously left instructions for the guidance of the commanding officer, in the event of any disruption of the ice, or other casualities, preventing his return to the ship.

"On the 26th of October, Captain M'Clure and his party reached Point Russell, and having ascended an elevation of about 600 feet, commanding a very extensive view, had the gratification of finding that their arduous and most fatiguing journey had not been in vain, for beneath them lay the frozen waters of Parry or Melville Sound, proving beyond doubt that 'a north-west passage from the Atlantic to the Pacific Ocean existed.'

"In honour of this event, Captain M'Clure named the strait in which he had left the Investigator after his Royal Highness the Prince of Wales.

"The party reached the ship again on the 31st of October, and remained frozen in until the 14th of July, 1851, when the ice broke up. Every effort was then made to get to Parry Sound; but, in consequence of the quantity of ice coming in from the northward, these efforts were not attended with success.

"The ship's furthest advance being lat. 73.14 N., and long. 115.32 W., Captain M'Clure therefore determined on bearing up, and attempted a passage into Parry Sound, to the westward, and along the shore of Baring's Land, which he was induced, from apparent circumstances, to consider an island.

"On the 14th of August he accordingly returned southward, and, rounding Nelson's Head, made his way along the west shore of that island, accomplishing what Captain M'Clure, in his published despatches, has styled, 'The terrific passage of that terrible Polar sea;' and on the 24th of September, after several providential escapes, succeeded in bringing the Investigator into a bay on the northern coast, which, in thankfulness for his preservation, he has appropriately named the Bay of Mercy, and in the same night was firmly frozen in.

"It being now evident that the Investigator had taken up her winter quarters, and her release upon the following season being doubtful, Captain M'Clure thought it advisable to place himself, his officers, and crew upon two-third allowance of all species of provision, and this was rigidly adhered to during the period of 20 months, in a climate where a greater supply of food is required to sustain men in a healthy condition than in others more temperate. These privations were borne by the crew with uncomplaining fortitude, notwithstanding their effects became painfully visible as their third winter drew towards a close, in all by their altered personal appearance, and in some by their weakened mental faculties.

"On the 11th of April, 1852, Captain M'Clure proceeded with a party by sledge to Winter Harbour, in Melville Island, depositing a cylinder containing a summary of his proceedings, and returned to the ship on the 9th of May, where he remained for 11 months.

"On the 6th of April, 1853, Captain M'Clure received a communication, brought by Lieutenant Pim, who had been dispatched from Melville Island by Captain Kellett, who had found the record left there by Capt. M'Clure in April, 1852, and on the 7th crossed that portion of the Arctic Sea now called Banks's Strait, to that officer's ship, at Dealy Island, a small island off Melville Island, which he reached on the 19th, and arranged with Captain Kellett, that if 20 volunteers could be found to remain with him, in the hope of extricating the Investigator during the navigable season of 1853, he had his permission to do so, if not, Captain M'Clure and his crew were to abandon their ship and join the Resolute, Captain Kellett.

"About this period Lieutenant Cresswell, of the Investigator, was despatched by Captain M'Clure to England to report the position of that ship.

"Captain M'Clure rejoined the Investigator on the 19th of May, and finding that a sufficient number of men would not volunteer to remain, he was compelled to leave the Investigator in the Bay of Mercy, which he did on the 3rd of June, and reached the Resolute on the 21st.

"On the 18th of August Captain M'Clure, his officers and crew, quitted Dealy Island in the Resolute, and were again frozen south-west of Cape Cockburn, and remained there until the 10th of April, 1854, when Captain M'Clure and his crew proceeded by sledge 180 miles to join the North Star at Beechey Island, which they reached on the 27th.

"On the 26th of August they proceeded in her down Barrow's Straits, across Baffin's Bay, to Disco, on the west coast of Greenland, where Captain M'Clure was transferred, early in September, to the Phœnix, under the command of Captain Inglefield, a very distinguished Arctic navigator, who in another direction had penetrated by Smith's Sound to the 78° 36′ N. degree of latitude. They arrived safe at Cork on the 30th of the same month, having been four years and eight months in effecting a passage between the Great Pacific and Atlantic oceans, performing what has been so graphically described by an American writer of some celebrity, Lieutenant Maury, of the United States' navy, 'That Captain M'Clure and his followers were the first to put a girdle round the great continent of America.

"The evidence places beyond doubt that to Captain M'Clure incontestably belongs the distinguished honour of having been the first to perform the actual passage over water along the northern coast of America, between the two great oceans that encircle the globe. By this achievement he has demonstrated the existence, and traced the course of that connexion between these oceans, which, under the name of the North-west Passage, has so long been the object of perilous search and deep interest to the nations of the civilized world.

"In addition to the completion of a north-west passage, Captain M'Clure and his officers have explored about 2,000 miles of coast line where a blank has hitherto existed in our charts.

"In the accomplishment of this exploit Captain M'Clure exhibited those high qualities of enterprise, heroism, and endurance, which have

indeed been the common characteristics of the brave navigators who have carried the researches of British adventure far beyond the confines of the frozen seas, which at one time seemed inaccessible even to the skill and courage of British seamen. In the discovery of the double passage from the western waters of the Polar Ocean to the strait which Parry had many years ago reached from the east. Captain M'Clure has had the good fortune to complete the last link in the chain of discovery to which many intrepid and persevering enterprises have contributed. Few passages in the history of naval enterprise can command a deeper interest than belongs to the position of Captain M'Clure in the autumn of 1851. In the previous autumn he had penetrated to the northern extremity of Prince of Wales' Strait, a channel discovered by himself, and had reached at its entrance the frozen waters of Parry's Sound. Baffled by the ice in his attempt to force his ship into those waters by that channel, he attempted another course. With almost instinctive sagacity he came to the conclusion that the unknown and unexplored land to the west-ward of the Strait through which he had passed, was an island, and that along its northern coast there must be another passage from the open ocean into Melville Sound. He took the bold resolution to retrace his steps to the south-ward, and attempt to reach the same point by sailing round an unexplored tract of land, and braving the perils of a coast navigation, exposed to the pressure of the Polar Ocean. Your committee have already recorded the verification of his bold conjecture and the successful issue of this daring enterprise. Ample and honourable testimony has also been borne to the intrepidity with which he braved, and the judgment with which he met, the perils which attended his attempt; and your committee cordially unite in the tribute of admiration which this testimony has offered to the combination of prudence and daring which marked his conduct in the adventurous achievement in which he has succeeded.

Discovery of Important Greek Manuscripts.

In the winter of 1847, Mr. Harris was sitting in his boat, under the shade of the well-known sycamore, on the western bank of the Nile, at Thebes, ready to start for Nubia, when an Arab brought him a fragment of a papyrus roll, which he ventured to open sufficiently to ascertain that it was written in the Greek language, and which he bought before proceeding further on his journey. Upon his return to Alexandria, where circumstances were more favourable to the difficult operation of unrolling a fragile papyrus, he discovered that he possessed a fragment of the oration of Hyperides against Demosthenes, in the matter of Harpalus, and also a very small fragment of another oration, the whole written in extremely legible characters, and of a form or fashion which those learned in Greek MSS. consider to be of the time of the Ptolemies. With these interesting fragments of orations of an orator so celebrated as Hyperides, of whose works nothing is extant but a few quotations in other Greek writers, he embarked for England. Upon his arrival here, he submitted the precious relics to the inspection of the Council and Members of the Royal Society of Literature, who were unanimous in their judgment as to the importance and genuineness of the MS.; and Mr. Harris immediately set to work, and with his own hand made a lithographic fac-simile of each piece. Of this performance a few copies were printed and distributed among the *savans* of Europe,—and Mr. Harris returned to Alexandria, whence he has made more than one journey to Thebes in the hope of discovering some other portion of the volume, of which he already had a part. In the same year (1847), another English gentleman, Mr. Joseph Arden, of London, bought at Thebes a papyrus, which he likewise brought to England. Induced by the success of Mr. Harris, Mr. Arden submitted his roll to the skilful and experienced hands of Mr. Hogarth; and upon the completion of the operation of unrolling, the MS. was discovered to be the terminating portion of the very same volume of which Mr. Harris had bought a fragment of the former part in the very same year, and probably of the very same Arabs. No doubt now existed that the volume when entire consisted of a collection of, or a selection, from, the orations of the celebrated Athenian orator Hyperides; and Mr. Arden, with a liberality and energy that cannot be too highly commended, forthwith gave to the world a beautiful fac-simile of his portion of the treasure, edited by the Rev. Churchill Babington; and this is the book to which Mr. Harris alludes in another part of his letter.

The portion of the volume which has fallen into the possession of Mr. Arden contains "fifteen continuous columns of the 'Oration for Lycophron,' to which work three of Mr. Harris's fragments appertained; and likewise the 'Oration for Euxenippus, which is quite complete and in beautiful preservation." Whether, as Mr. Babington observes in his Preface to the work, "any more scraps of the 'Oration for Lycophron' or of the 'Oration against Demosthenes' remain to be discovered, either in Thebes or elsewhere, may be doubtful, but is certainly worth the enquiry of learned travellers." The condition, however, of the fragments obtained by Mr. Harris but too significantly indicate the hoplessness of success. The scroll had evidently been more frequently rolled and unrolled in that particular part—namely, the speech of Hyperides in a matter of such peculiar interest as that involving the honour of the most celebrated orator of antiquity—it had been more read and had been more thumbed by ancient fingers than any other speech in the whole volume; and hence the terrible gap between Mr. Harris's and Mr. Arden's portions. Those who are acquainted with the brittle, friable nature of a roll of papyrus in the dry climate of Thebes, after being buried two thousand years or more, and then coming first into the hands of a ruthless Arab, who, perhaps, had rudely snatched it out of the sarcophagus of the mummied scribe will well understand how dilapidations occur. It frequently happens that a single roll, or possibly an entire box, of such fragile treasures is found in the tomb of some ancient philologist or man of learning, and that the possession is immediately disputed by the company of Arabs who may have embarked on the venture. To settle the dispute, when there is not a scroll for each member of the company, an equitable division is made by dividing a papyrus and distributing the portions. Thus, in this volume of Hyperides, I should conceive that it had fallen into two pieces at the place where it had most usually been opened, and where, alas! it would have been most desirable to have it kept whole; and that the smaller fragments have been lost amid the dust and rubbish of the excavation, while the two extremities have been made distinct properties, which have been sold, as we have seen, to separate collectors. So, at all events, such matters are managed at Thebes.

Mr. Harris mentions fragments of the 'Iliad' which he had purchased of some of the Arab disturbers of the dead in the sacred cemetries of Middle Egypt, most probably Saccara. I should be disposed to differ from the inference that these copies were written in Middle Egypt, or that the copies were found at Thebes were written in Upper Egypt; as I cannot but think it more probable that all Greek manuscripts found in Egypt, in whatsoever part, were written or copied at that great emporium of literatnre, or the Library of Alexandria, and thence carried into remoter districts by the learned, and, ultimately, as a valuable treasure, buried with them.—*Athenæum.*

JOSEPH BONOMI.

The late Earthquake.

The whole east of France from Valence up to Metz felt very perceptibly the shock of an earthquake which, as has been already mentioned, did some slight damage at Lyons on the 25th at noon. At Grenoble three or four distinct oscilliations were felt, which lasted during a period of about 30 seconds. The clock of the cathedral was stopped. At about the same time a strong shock was felt at Lons-le-Saulnier, the oscillations, which followed each other in rapid succession, appearing to be in the direction from east to west. Several of the ceilings of rooms in upper parts of houses were cracked and thrown down. Some minutes before the shocks the cattle on several farms in this neighbourhood were heard to make that peculiar lowing which denotes a fear of approaching danger. The shock at Besancon also lasted for about 30 seconds. The furniture in some rooms was displaced, the bells set ringing, and some ceilings cracked. There was no particular atmospheric sign to announce the phenomenon. The weather wet and stormy, and the barometer above "variable." At Baume, in the Doubs, the shock was violent, several chimneys being partly thrown down and others damaged. At Belvoir, in the same department, the shock, which lasted six seconds, was so violent that the houses were felt to rock. Several chimneys were thrown down here, and many walls were much cracked. The movement was accompanied by a rumbling noise and by a strong smell of sulphur. At Strasbourg the shock was felt in the midst of a violent storm and heavy rain. The clock in the house of the keeper of the cathedral, and situate on the platform of the building, was stopped. The waters in the reservoirs was so agitated as to flow over the edges of the basins. The shock lasted nearly a minute. In the upper part of one of the barracks the soldiers ran out in great haste, imagining the house was about to fall. At

Dijon the shock, which was rather slight, was felt in the direction of north-east to south-west. The accounts received from Italy, Switzerland, and part of Germany agree in stating that the shock extended to all these countries. The time indicated varies from 10 to 20 minutes past 1, but the variation is probably only caused by difference of clocks. Among other places where the shocks where felt were Erbach, in the Odenwald, Carlsruhe, Friburg, the Baden Oberland, Stutgardt, Ravenburg, Esslingen, Plochingen, &c. In most of the places two or three oscillations were felt; they went from the north-east to the south-west, and were strong enough to shake the windows, ring bells, and displace light articles of furniture, but the barometer and thermometer underwent no variation. The sky was cloudy at the time, and the wind blew from the south-west. A letter from Milan of the 25th says:—"A severe shock of earthquake was felt at Milan this day, in the direction of east to west. It lasted five seconds, but caused no damage. Most of the clocks in the town stopped, and the thermometer fell from 27° Reaumur to 14° (93° to 63½° Fahrenheit). The weather was rainy, and on the following morning there was a a thick fog."—*Galignani's Messenger.*

Ship Canal across the Isthmus of Suez.

M. de Lesseps is now on his return from Egypt to Paris, probably to make the necessary arrangements for carrying out the project with which he has been so long occupied, and for which, it is believed, he has at last obtained the consent of the Ottoman Porte, that of the Viceroy of Egypt having been long ago and very readily given. This project is the important one of cutting a ship canal through the Isthmus of Suez, and thus making an expeditious and easy direct passage for ships of large size from the Mediterranean into the Indian seas. The line originally traced out for this canal was from Tineh to Suez, the narrowest point of the Isthmus; but, this, from a congregation of difficulties not then sufficiently studied, and from data and calculations erroneously founded, it was deemed necessary to abandon; the more so as the cost could not be less than 300 millions of francs, whereas that for the canal of greater length now proposed is estimated at no more than 240 millions. The establishment of a canal at the narrowest part of the Isthmus is besides surrounded with such difficulties of execution that the authors of the project now approved of by the Pacha of Egypt have decided in preference of the line by Alexandria and Cairo. The port of Alexandria and the roadstead of Aboukir are exempt from the obstacles to navigation which the Nile creates north-east of the Delta. A current running along shore from west to east carries away from Alexandria the mud brought down by the river, and keeps the waters of this part of Egypt clear and deep. By opening the canal at Alexandria the enterprise is saved the considerable and costly works necessary at Tineh. Canals of communication between the Mediterranean and Indian seas not only existed from the most distant period, but vestiges of them are still found, agreeing with the plan now proposed. There was, however, a very inportant difference between the ancient canal and that now in question; which is, that the first was almost exclusively devoted to internal navigation, and probably had but little depth of water. The present dimensions of the English ships trading between India and Europe oblige to enlarge the proportions of the projected canal. It is proposed to admit of the passage of large ships of war, and to maintain the necessary depth of water. The difficulty does not consist in the works to be executed for constructing the canal and locks, and for finishing all the other requisites, but in finding the means for feeding the canal to a depth for large ships. After extended surveys it has been found that the water supply cannot so readily be procured from the two seas as had been conceived, and that recourse can be more easily and conveniently had to the waters of the Nile, for that river has been ascertained, contrary to former belief, to have an elevation considerably above that of the sea.—*Civil Engineer and Architects Journal.*

Charcoal as a Deodoriser and Disinfectant.*

There are many substances known to the chemist which are distinguished by possessing what are termed antiseptic properties; that is, they possess the power of checking or impeding decomposition in other bodies; they are, in fact, powerful conservators. There are a few other substances which add to this antiseptic power another still more remarkable: this is the property of absorbing and firmly retaining the fœtid exhalations and products of decomposition, so that an infected atmosphere, or solid or fluid matter, may be rendered sweet and wholesome by their mere contact. The substance which enjoys in the highest degree these conjoined powers, is common charcoal. Perhaps there is not within the range of chemistry a more remarkable instance of the forcible influence which one sort of matter is capable of exerting over another, than is to be found in the action of charcoal upon gaseous bodies of every kind. Under ordinary circumstances, and relatively to mechanical forces, we know that the mere condensation of the permanent gases into a very greatly diminished bulk is a problem not too easy to solve. How extraordinary and powerful must, then, be the attractive force which not only condenses these gases to a most remarkable extent, but which is capable of retaining them for an indefinite period in this state of condensation! It has been ascertained, by experiment, that freshly-burned wood charcoal placed in an atmosphere of either of the following gases will, in the course of twenty-four hours, absorb the quantity stated in the table.

Ammonia	90	Bicarburetted Hydrogen.	35
Muriatic Acid	85	Carbonic Oxide	9·42
Sulphurous Acid	65	Oxygen	9·25
Sulphuretted Hydrogen	55	Nitrogen	7·50
Nitrous Oxide	40	Carburetted Hydrogen	5·00
Carbonic Acid	35	Hydrogen	1·75

The numbers indicate the number of volumes of gas respectively which one volume of charcoal can absorb; but it may be remarked that the extent of the absorptive action increases as the temperature at which the experiment is made diminishes. The action is also not confined to these substances while they are in the free gaseous state; those which are soluble in water are removed in their solution by the same means; so that water contaminated by the gases which arise from rotten vegetable matter is rendered perfectly pure and inodorous by mere filtration through a layer of charcoal, or even by placing a few pieces of fresh charcoal in the vessel containing it. Unlimited experience has shown that the most fœtid substances may be rendered perfectly odourless and innoxious by means of charcoal; and what can be more valuable, in a sanitary point of view—or rather, what may be more valuable, if we chose to avail ourselves of it to the utmost—than the knowledge of this fact? The dangerously unwholesome state of the densely-crowded and populous towns arises from the accumulation of malarious exhalation, in consequence, first, of the overcrowding of the dwellings, and secondly, from the want of proper sewerage and ventilation. If any cheap and ready means could be employed for preventing or destroying these exhalations, how much may be done towards assisting and establishing a complete and effective sanitary reform!

In speaking of the practical application of charcoal to this purpose, we must consider it as possessing the distinct properties both of an *antiseptic* and of a *disinfectant;* and it is in this respect that the use of charcoal is particularly advantageous when compared with that of the chemical agents which may be employed for a similar purpose. In an infected atmosphere it is well known that provisions are more prone to run into a state of decomposition than when the air around them is fresh and pure. It is, therefore, difficult to preserve either solid food, or even water, in a state fit for human consumption, where the atmosphere is charged with a poisonous effluvia, as is so often the case in dwellings of a certain class. Under such circumstances, what a valuable sanitary agent charcoal may be rendered by virtue of its *antiseptic* properties! Meat, fish, or any matter readily obnoxious to decay, may be preserved for a very considerable time if kept surrounded with pieces of charcoal; and even if incipient decomposition be established, it may, in a similar manner, be immediately checked, and the material rendered wholesome and fit for food. As a *disinfectant,* charcoal is even more effective. The admixture of charcoal in powder with the contents of cesspools or sewers will wholly deprive them of odour; the most fœtid sewage liquor, mixed with a little charcoal powder, and afterwards filtered to remove the solid matter, could not be distinguished from the purest water, either by appearance or smell. It is the same with the soil from cesspools: after being mixed with a proper quantity of charcoal, every trace of mal-odour is removed, and the mixture may be transported from place to place without the least offence against public convenience or prejudice to the public health. The mere scattering of a layer of the powdered charcoal over the surface of soil effectually prevents the effluvia from escaping, and, undoubtedly, the exposure of a considerable surface of the same material, in shallow trays, for instance, would in a great measure, if not entirely, purify the infected atmosphere of ill-ventilated dwellings.

* London Artizan. See also *Canadian Journal,* Vol. III., p. 196.

The powerful action of charcoal upon gases and vapours is not limited to them; it extends to many organic principles, as, for instance, the colouring matter of vegetable infusions, and even to the principles upon which the peculiar flavor of certain vegetable matters depends, such as the intense bitter of gentian and quassia. What renders this action the more remarkable, is the fact that it appears to be entirely independent of ordinary chemical action. The charcoal effects no change in the matters over which its influence is exerted—it merely seizes upon them by virtue of some powerful surface attraction; but any substances thus retained by charcoal can be easily re-obtained in their normal character by the employment of certain chemical means. Neither is the disinfectant property confined to any particular kind of charcoal. That obtained from the various bituminous minerals appears to act as well as that from wood, but the charcoal from peat is perhaps the most suitable to sanitary purposes. An excellent charcoal may be manufactured from spent tan; and in the neighbourhood of large towns, many refuse matters may easily be burned into a material which will operate extremely well as a disinfectant.

In France this substance has been largely employed for the last fifteen years as an adjunct to sanitary purposes, in the purification of water. It affords a ready means of effecting the latter; and it is greatly to be desired that its excellent properties, both in this respect and as a disinfectant, should become generally known.

Marine Losses on the Lakes in 1854.

The following tables show the cause of disaster, amount of loss, and character of vessel, in 1854.

The disasters for the several months compare in number as follows:

Months.	No. in 1852.	No. in 1853.	No. in 1854.	Amount in 1854.
April	7	19	48	$320,900
May	19	30	27	217,000
June	24	17	11	40,900
July	15	11	13	58,921
August	16	28	21	68,000
September	21	30	40	129,000
October	27	39	66	408,000
November	85	80	84	456,000
December	15	12	68	490,000
	229	268	384	$2,186,921

Causes.	Steam Vessels. No.	Steam Vessels. Loss.	Sail Vessels. No.	Sail Vessels. Loss.	Total. No.	Total. Loss.
Wrecked and sunk.	9	$480,000	51	$509,626	60	$787,626
Fire	4	240,000	2	22,500	6	262,500
Stranded	2	110,000	51	507,626	2	110,000
Damaged, &c.	54	140,300	198	321,375	252	461,675
Jettison	8	72,000	22	36,770	30	108,770
Collisions	16	100,700	18	155,650	34	256,350
Total	93	$1,143,000	291	$1,043,991	384	$2,186,921

RECAPITULATION.

	No.	Loss.
Steamers	41	$463,400
Propellers	52	679,500
Barks	17	148,000
Brigs	65	184,125
Schooners, &c.	219	711,796
Total loss		$2,186,921

The proportion of losses on each of the four large Lakes traversed by the shipping is shown by the following figures for the past three years:—

	1852.	1853.	1854.
Ontario	$ 78,939	$288,077	$ 246,300
Erie	741,300	250,512	1,113,271
Huron	89,600	161,338	411,500
Michigan	78,820	212,316	397,950

The proportion of steam to sail craft by which losses occurred during the last seven years is shown by the annexed table.

Years.	Steam.	Sail.	Total.
1848	$140,000	$280,512	$420,512
1849	185,900	182,271	368,171
1850	281,700	277,126	558,826
1851	348,700	381,837	730,537
1852	635,620	359,039	994,659
1853	461,800	412,343	874,143
1854	1,143,000	1,043,991	2,186,921

The loss of life attending the disasters of 1854, is stated at 119, of which 18 were on Lake Ontario, 40 on Lake Erie, 12 on Lake Huron, and 49 on Lake Michigan. The loss of life for the series of seven years, compare as shown by the figures below:

1848	55
1849	34
1850	395
1851	79
1852	296
1853	81
1854	119

The nature and causes of the disasters which resulted in these losses during the last three years, compare as follows—

Causes.	1852.	1853.	1854.
Wrecked and sunk	$730,709	$608,871	$987,626
Fire	....	132,055	262,500
Stranded	......	....	110,000
Damaged &c.	....	....	461,675
Jettison	....	....	108,770
Collisions	261,950	55,823	256,350
Explosions	....	77,394	....

Manufacture of Paper.

During the recent discussion on the Fibre Company's Bill in the House of Lords, the Earl of Hardwicke stated some interesting facts bearing upon the great paper question. The substance of the noble Earl's remarks were as follows:—

It was well known that the supply of paper had fallen off as the desire for its use had been extended. The result was an enormous increase in its price, and the Government revenue had fallen off in consequence of the diminished supply of the raw material from which it was manufactured. The attention of men of science had been directed to the subject, and rewards had been offered for such an improvement in the manufacture as would increase the supply of raw material. The machines requisite for reducing the raw material to pulp were, however, very expensive, and required a great deal of capital. The war with Russia had diminished the supply of hemp, and flax, from which the article was partly produced. The efficacy of the plan of this company had been tested, as he had explained on a former occasion, when he had shown their lordships a copy of the *Times* newspaper made from pulp of a material manufactured as this company proposed to manufacture it. The invention was thus shown to be excessively useful and the paper sufficiently good for all the purposes for which it was made. In the five years from 1830 to 1834 the amount of paper manufactured in Great Britain was on an average 70,988,131 lb., while in the five years from 1849 to 1853 the average annual quantity produced had risen to 151,234,175lb. In the year 1853 the production was 177,633,000 lb., being above 23,000,000lb., or 10,000 tons more than the preceding year. Taking into account the higher price of paper-making materials, it was estimated that the cost of production to our own manufacturers during the present year would exceed that which the same weight of paper would have cost in 1852 by no less a sum than £1,000,000 sterling. While an increasing quantity was still desired the price of the raw material continued to increase, and had risen from 26s. per cwt. first quality in 1852 to 34s. in 1854. The state of the European markets with regard to the supply of the raw material was equally lamentable, there being an increased demand in those countries as well as here. There was some statistics upon the consumption of paper by the *Times* which might interest their lordships. The *Times* published 60,000 copies of that paper daily. The weight of the paper upon which it was printed was nine tons per day, and if the copies were spread upon a flat surface they would make a column of 50 feet in height. In 1851, 1852, and 1853 there were imported from Russia 152,759 tons of hemp. The average supply being 50,920 tons per annum, and the supply from all other parts of the world being only 21,000 tons. The supply from Russia, it was true, was not entirely cut off by the war, but the cost had been greatly enhanced. The result was that 119,118 tons was the amount of deficiency in the material existing at the present moment.

Specification of the Patent

Granted to James A. Cutting, *of Boston, in the United States of America, Photographer, for an Improved Process of taking Photographic Pictures upon Glass, and also of Beautifying and Preserving the same.*

[Dated London, July 26, 1854.]*

This invention consists in an improved process of taking photographic pictures upon glass, and also of beautifying and preserving the same, which process I have styled "Ambrotype." My improved process has reference to the art of taking pictures photographically on a film of collodion upon the surface of a sheet of glass, the collodion being suitably prepared for the purpose. By the use of the said process, the beauty and permanency of such pictures are greatly increased, and I have, on this account, styled the process "ambrotype," from the Greek word ambrotos, immortal.

The first part of my invention consists in the use of alcohol, for the purpose of depriving the gun-cotton, of which the collodion is made, of its moisture after it has been washed, to free it from the acids used in its manufacture.

It has been found that where the gun-cotton has been exposed to the action of the atmosphere for the purpose of drying it, the sensitiveness of the collodion prepared from it is sensibly diminished. By the use of alcohol it may be deprived of its moisture after being washed, without exposure to the air, and without the consequent deterioration of its sensitiveness. This part of my process I conduct as follows—So soon as the cotton has been sufficiently exposed to the acids, and has been thoroughly washed, it is plunged into strong alcohol, which effectually deprives it of the water which it contains, without exposing it to the atmosphere for the purpose. From this alcohol it is taken immediately to the mixture in which it is to be dissolved for the purpose of forming the collodion. This mixture consists of ten parts of sulphuric ether and six of alcohol, or thereabouts. The collodion thus formed is allowed to remain until it has settled perfectly clear, which usually requires about twenty-four hours. It is then decanted, and to every pint is added eighty grains of iodide of potassium dissolved in alcohol. It is then well shaken, and thirty-two grains of refined gum camphor is added to each pint of the collodion, and after it is again settled it is fit for use. The object of the camphor is to increase the vigour and distinctiveness of delineation of the positive pictures, and particularly of the half tints. It also greatly increases the beauty of the picture, by giving a fineness of deposit not heretofore attained by any other means. The use of the gum camphor in the manner above described forms the second branch of my invention. The collodion is then applied to the surface of the glass in the following manner:—

The plate of glass being held horizontally, a portion of the collodion is poured upon it, and it is then inclined in different directions, so as to cause the collodion to flow over its whole surface, upon which it forms a colorless transparent film; the excess of collodion is then allowed to run off, and the glass, being still held horizontally, is inclined to one side and the other, until the collodion becomes partially thickened or set. When this has taken place, and before it is dry, it is rinsed in a solution of crystallized nitrate of silver, of a strength of forty grains to the ounce of water; the film is thus impregnated with iodide of silver, and after remaining in this bath a sufficient length of time for the ether to escape from the collodion, the plate is ready to be placed in the camera. After being exposed a sufficient length of time in the camera, it is taken to a dark room, where the latent picture is developed, by the application of a solution of protosulphite of iron, acetic acid, and nitric acid, in about the following proportions:—One quart of soft water, one ounce protosulphite of iron, thirty-two drms. No. 8 acetic acid, one drachm nitric acid. These exact proportions are not rigid, but I have found them to be sufficient for the purpose of developing the picture. After this is accomplished, it is washed in clean soft water, and then the remaining iodide of silver is dissolved from the collodion film by a solution of hyposulphite of soda, after which the picture is entirely cleansed by the hyposulphite solution by washing as before, in soft water. The picture is then dried, either in the open air, or by the aid of a gentle heat, and the process is completed.

To permanently improve the beauty of the pictures, and to deprive them of a bluish, hazy, and indistinct look, is the object of my third improvement; which consists in the application of a coating of balsam of fir to the surface of the glass upon which the picture is made, the balsam being confined to the picture plate by a secondary plate of glass, which is applied to the picture plate in a manner which will now be described, and which hermetically seals up the picture and protects it from every and any injury not sufficient to fracture the glasses themselves. This part of the process will now be described.

A second plate of glass is prepared, of the same size as that which carries the picture, and is thoroughly cleansed; the picture plate is then held horizontally, the picture side uppermost. The balsam is then applied in a line along one edge of the glass, and one edge of the secondary plate is then applied to the edge of the first, which contains the balsam. The two plates are then pressed gradually together, by which the balsam is caused to flow entirely across the picture towards the opposite edge, and the air is effectually excluded from between the plates. The superabundant balsam is then removed by pressing the glasses together, and a thin coating of it only is left upon the surface of the picture. The beauty and distinctness of the pictures are greatly enhanced by this application, the finer lines as well as the dark portions and shadows being rendered far more distinct, and the most minute delineations being brought out and made visible, while the application of the second plate of glass secures the whole from the action of air, moisture, and dust.

What I claim for my invention is,

1st. The method of depriving the gun-cotton of its moisture by the use of alcohol, whereby the sensitiveness of the collodion prepared therefrom is preserved unimpaired.

2d. The use of gum camphor in the preparation of collodion for the purpose set forth.

3d. I am aware of the previous use of balsam for the purpose of cementing together lenses, and also of securing microscopic objects, and I therefore lay claim to no such use.

But what I do claim, is the application of the balsam to the surface of photographic pictures upon glass in combination with the method described of protecting and securing the same by means of the additional plate of glass.

* From the Repertory of Patent Inventions, April, 1855.

Professor Owen on the Social position and rewards of Scientific merit in England.

At the annual dinner of the Society of Arts, which recently took place at the close of the one hundred and first Session of that important British association, Professor Owen touched upon a topic of great and increasing interest, viz.: the social position, national relations, recognition and rewards of scientific merit in the British Isles.

"What these were of old—how they were once viewed—we see in the provisions made in mediæval times for the due dignity and independence of such master-minds as might achieve the higher posts at our Universities, such positions, for example, as the Deanery of Christchurch, Oxford, the Mastership of Trinity College, Cambridge, which the wisdom of our ancestors established for those men who won renown in the sciences, which alone were recognised in the time of the foundation of those and the like independent and dignified offices. The human intellect has since extended its conquests over a wider range and different fields; more congenial, perhaps, to its true aims and powers than the scholastical, logical, and theological studies which represented science before Galileo and Bacon. Has England continued to cherish and foster in the same spirit the new and fruitful Natural Sciences, as she honoured herself and manifested her wisdom by doing, in relation to the older forms of human knowledge? What, for instance, at the present period of her unexampled wealth, due mainly to the application of the abstract discoveries of science—what is the national relation of her Faraday? What is my own? Are we labouring, lecturing, in national institutions, in fixed positions, absolutely exempt from the annoyance of individual interference or caprice, in the peace-giving certitude of the continuance of hardly-earned emoluments, with the cheering conviction of a suitable retiring provision when the wearied brain begins to fail in its wonted and expected efforts? As working men in our line, with bread to earn by the work we do, England owns us not; she ignores us in the sense in which she recognised and provided for her mediæval teachers. We are merely the servants of particular chartered bodies. As a comparative anatomist, indeed, I deem myself fortunate among my fellow-workers in the place I hold, but it needs only that a majority of the Council of the College of Surgeons should so will and vote it, and after nigh 30 years' service I must begin the world afresh. My masters are irresponsible, or only remotely responsible, to public opinion. Hitherto England has devised no other or better position for the man whom she may delight to ho-

nour by calling "her Cuvier," than the curatorship of a museum belonging to one section of the medical profession. In my own case, indeed, the Council of the Surgeon's College have done me the honour to re-elect me annually, for some years past, to a professorship not previously held by the curator of their museum. But this position has none of that fixedness and independence which my brother professors of the same science on the Continent enjoy. When the First Consul of France revised the appointments and position of the professors in the national establishment of the Garden of Plants at Paris, the salary which he attached to the chair of comparative anatomy, with which the secretaryship of the sciences, was then associated, the appointment, I say, was on such a scale, that the finance minister remonstrated. "Cuvier," replied Napoleon, "has a position in science; it is for the honour of France that he should be able to maintain that position towards the foreign *savans* who may visit Paris." Great is the pleasure with which I can state, that the short-comings of our national arrangements for analagous cases have been well understood by the most illustrious personages and individuals of the State, who have generously endeavoured to remedy and compensate for them. The noble lord at the head of foreign affairs, in the most handsome terms, gave my son a clerkship in his office. Sir Robert Peel in assigning to me, a short time before his lamented death, a pension of £200 a year, well appreciated the acceptability of such a provision in the exemption from anxiety flowing therefrom. I shall never cease to gratefully cherish the memory of the wise and benevolent statesmen, who created for me the satisfaction of feeling that, whatever might possibly cause a termination of my present appointments, I do not thereby fall into utter destitution. Her most gracious Majesty, measuring my humble merits by the standard of her own greatness of mind, was pleased to offer me, as a residence, the mansion of the late King of Hanover, at Kew. On my respectfully representing to her illustrious consort, your gifted and philosophic president, the disproportion of my means to the fruition of that royal gift, he was pleased to suggest the assignment to my use of a beautiful cottage, in which the most healthful and delightful hours of my life have been spent, and which daily renews a grateful sense of the happiness and privilege we enjoy in the benign reign of Victoria."

Cedar from Canada.

In a letter to the Editor of the Journal of the Society of Arts, Mr. W. B. Adams, makes the following observations on a remarkable kiud of Cedar from Canada.—

"In the arsenal at Woolwich is being consumed for all kinds of common purposes, as purchased at a common price, a wood of very remarkable quality. It is a cedar of the usual colour and odour, but of a grain and veining equal to the finest maple. I was informed that it comes from Canada amongst the usual supplies. I never recollect to have seen it in Canada, where very durable post and rail fences are made of common straight-grained (pencil) cedar. Perhaps it might have been shown in the Great Exhibition, but if so I did not remark it. Possibly some of your correspondents, either here or in Canada, may give us the information, and make this wood known for the purposes it is better fitted for in the elegancies of life. The Temple of Soloman in all its glory could have had no more beautiful cedar than this, supposing the temple cedar to have been red and not white, as the modern cedars of Lebanon."

It almost makes one think that trees have faculties like the higher classes of human beings to grow like by proximity. This cedar looks as though it had been dry-nursed by a maple, and had caught its manners and features while preserving its own complexion.

Natural History Society of Montreal.

An ordinary meeting of this Society was held in the Museum, on Monday evening, August 27th. There were present—the Rev. Canon Leach, D.C.L., Professor W. Andrew, Dr. Workman, Dr. Wright, Dr. Fraser, Dr. Hingston, Dr. M'Callum, Messrs. G. Browne, J. T. Dutton, and A. W. Rennie. Professor Andrew in the chair.

The following donations were received, and the thanks of the Society ordered to be conveyed to the respective donors:—

From Dr. W. Newcomb, of Albany, New York, a very valuable donation of a complete suite of the Genus *Achatinella*, consisting of seventy-seven different specimens of shells, labelled and numbered, with printed catalogue and description, which a residence of over five years in the Sandwich Islands enabled him to furnish.

From John M'Gee, Esq., of Melbourne, C.W., six specimens of minerals.

From the Smithsonian Institution of Washington, the seventh volume of their contributions to knowledge.

From W. Bristow, Esq., of Montreal, a specimen of Silurian limestone, with fossils.

From Wm. Hutton, Esq., Secretary to the Board of Statistics, &c., Quebec, the Census Volumes, 1st and 2d, in English and French; Trade and Navigation Returns for 1854; Outlines of Flemish Husbandry; Lord Elgin's State Resources of Canada; Report of Public Works for 1853; and Hogan's Prize Essay.

From A. N. Rennie, Esq., six specimens of copper ore.

Dr. Wright read a communication from Dr. Holmes, to the effect, that he was desirous to have withdrawn from his custody some scientific apparatus belonging to the Society, which had been purchased by the proceeds of a course of lectures delivered by him many years ago on Mineralogy and Chemistry. The cabinet keeper was instructed to receive the same when the proposed alterations in the rooms were completed, and officially acknowledge their receipt.

A report from the Council was read, recommending that the plans submitted by George Browne, Esq., for altering and improving the Society's building should be adopted, and that the meeting authorize the Council to borrow upon the security of the Corporation whatever amount might be necessary to complete the same. Mr. Browne stated that the roof of the house was in want of some necessary repairs immediately, and explained the improvements he proposed to make, by the enlargement of the Council room and Library of the Society. He also informed the meeting that at a very trifling expense, a very large and commodious lecture-room could be made on the third floor of the Society's building, and mentioned the amount he thought it would be necessary to raise, to effect these desirable alterations. Whereupon, it was resolved, upon motion by Dr. Workman, seconded by Mr. Dutton—That the plan and estimate respecting the repairs of the Library and Council room be received and adopted. Upon motion by Dr. Fraser, seconded by Rev. Canon Leach,—That Mr. Browne be authorized to have the necessary repairs for rendering the Society's building wind and water-tight, executed immediately. Upon motion by Dr. McCallum, seconded by Mr. Rennie,—That the alterations in the building, necessary to give the Society a large and commodious lecture room be approved of, and that Mr. Browne be authorized to draw up the plans, and procure the necessary estimates. And upon motion by Dr. Hingston, seconded by Mr. Rennie,—That the Treasurer be authorized to borrow, upon the security of the Society, a sum not exceeding four hundred pounds currency, to carry out the alterations and improvements now agreed to be made, according to the plan and specifications submitted by Mr. Browne.

The Librarian presented a list of books of reference, uot to be taken out of the Library save for a special purpose, and upon application of the Librarian to the Council for permission. The list was sanctioned, ordered to be printed, and hung up in a conspicuous part of the Library.

Dr. Robert. Craik, of Montreal, was then proposed as an ordinary member; and the meeting adjourned.

(A true copy.) A. W. RENNIE,
Montreal, August 31st, 1855. *Recording Secretary.*

Miscellaneous Intelligence.

Adulteration of Oils.—The detection of oils obtained from the cruciferous vegetables, such as colza, rape, camelina, mustard, when mixed with other oils, has hitherto been a matter of some difficulty. The following test is proposed by Miahle:—25 to 35 grammes of the oil in question are boiled in a porcelain capsule, with two grammes of pure caustic potash (prepared with alcohol) dissolved in 20 grammes of distilled water. After boiling for a few minutes, it is thrown upon a filter previously moistened, and the alkaline liquor flowing from it is tested with paper impregnated with acetate of lead or nitrate of silver. A black stain, showing the presence of sulphur, indicates that one of the above oils has been added. A still more delicate method is to boil the mixture in a silver capsule, which will be blackened if one of the above oils be present even to the proportion of one per cent.—*Artizan.*

Copper Coinage.—In 1844, Sir J. Morrison estimated the weight of the copper coins of this country to be 5,000 tons. In the past year alone, there were added 270 tons, forming above 25 million of single pieces, viz., 6,800,000 pennies, 12,400,000 halfpennies, and 6,500,000 farthings, copper coinage.

Oil and Alcohol.—A letter from Algiers, of the 15th inst., says that M. Duplat, a chemist attached to the military hospital at Blidah, had succeeded in producing oil and alcohol by distillation from acorns growing in the oak forests which cover Mount Atlas. One hundred pounds weight of acorns produced half-a-pound of oil and five pounds of alcohol, perfectly suited for chemical purposes.—*Times Paris Correspondent.*

Steam Fire-Engines.—The *Cincinnati Commercial* contains the report of a Committee of citizens to witness the performances of a new steam fire-engine, named "Young America," and built in the machine shop of Abel Shawk, and according to his patent. In this report it is stated, that in twelve minutes exactly, from applying the match, the engine commenced its work, and the pumping of water began. The first experiment was made by using a nozzle 1⅛ inches in diameter, playing horizontally, the water being thrown 210 feet. The next experiment was with a nozzle 1¼ inches in diameter, in the same direction. Upon actual measurement, it was found that the water had been fairly thrown a distance of *two hundred and twenty-nine feet and four inches.* It also forced a stream of water through the 1¼ inch nozzle ten feet over the tower of the Mechanics' Institute, 160 feet high; and had the wind not been so strong, it would have thrown the stream higher still. The Committee, after a number of experiments, unhesitatingly declared, they were perfectly satisfied, and considered the engine a triumph of which Cincinnati might be proud.

Telegraph to India.—The remainder of the submarine telegraph cable required to complete the communication to Algiers *via* Corsica and Sardinia has just been shipped from the manufactory at Greenwich. It is 162 miles in length, containing six conducting wires, and weighing 1,250, tons. It will be laid from the southernmost point of Sardinia to the coast of Africa, near Algiers, and is regarded by the parties connected with the undertaking as the commencement of a line to India and Australia, *via* Malta, originally projected by them.

From Cape Spartivento the company proposes to go to Malta, and, arrived there, to stretch one line of telegraph by Corfu across the isthmus of Greece to Constantinople, and another by Alexandria, Suez, Aden, and the coast of Arabia to Kurachee, where communication with the Indian system will be established. For the completion of this extensive route not more than 1,000,000*l.* of capital would be required, and it is confidently asserted that the whole might be finished in two years and a-half.

Important Discovery.—It was stated a few days since by Sir Walter C. Trevelyan, at a meeting of the Somerset Archæological Society, of which he is President, that a discovery had been made in the Brendon-hills, Somerset, of a vast quantity of carbonate of iron. This metal has heretofore been obtained chiefly from Silesia, and is used for the manufacture of steel. The size of the vein in these hills is said to far exceed that in the continental mines, and the discovery promises to be of great value, the amount annually expended in the purchase of this description of iron being about three quarters of a million sterling.

Canadian Telegraph Companies.—There are three Telegraph Companies, whose wires extend throughout the Province, viz.: the Montreal Telegraph, the British American Telegraph, and the Grand Trunk Telegraph Companies. The office of the first is in the Montreal Exchange, and its wires work direct to every important town in Canada, to Portland and all intermediate stations on the Grand Trunk Railway, to Boston by two distinct lines, to New York via Troy (the only direct route) and connect with lines to all parts of the United States and the Eastern Provinces. The British American Telegraph Company, office, St. Francois Xavier Street. This line runs from Quebec to Halifax direct, and to all ports below Quebec. Its wire also extends to Montreal and connects with the Grand Trunk Telegraph wires in this city,—these latter having connection with every town and village of any importance between Montreal and Buffalo. The average charge of messages is about 8d. currency for 10 words per 100 miles.—*Canadian Railway and Steamboat Guide.*

Suspension Bridge over the Dnieper at Kieff.—There is in the gallery at the Crystal Palace a beautiful model of the suspension bridge erected by our countryman and engineer, Vignolles, over the Dnieper, at Kieff, for the Emperor of Russia. It is on a scale of 1 inch to 8 feet, was constructed by Mr. Jabez James, Broadwall, Lambeth, and assistants, and is a perfect representation, even in its most minute details, of the original. This bridge is 2562 ft., or nearly half a mile in length, 52½ ft. wide, each of the four openings between the piers, 440 ft., and two side openings 225 ft. each. A swivel bridge at one end for the passage of ships, is 50 ft. clear in the opening; the water way at highest floods 2140 feet. The test load was 3000 tons, and it is calculated to bear 2350 tons. The clear height from the foundations of the piers is 112 feet. It was commenced on Sept. 9, 1848, and opened Oct. 10, 1853.

Immigration into Canada.—The annual returns of the immigration into Canada during the past year have just been published, and show a large increase, the total from the united kingdom and the continent of Europe having been 53,183, against 36,699 in 1853. The average length of the passage from the united kingdom was 47 days, and from continental ports 58 days. By the steamers from Liverpool it was 16 days. Since 1851 the emigration from Ireland to Canada has shown a great excess of females over males, the result, probably of men who have succeeded well in the colony having sent remittances for their relatives to join them. Last year the excess was 2,209 women, being double that of the previous year. Three vessels were lost during the season, but without any sacrifice of life. Scarcely any complaints were made of infringements of the Passenger Act, but some defects of that Act were rendered apparent, which call for remedy. The chief of these is the system of issuing the provisions in an uncooked state, the struggle for the use of the stoves leading to violence and oppression on the part of the strong over the weak and timid. Of the total 53,183 immigrants, 35,132 were of British origin, the remaining 18,051 being foreigners. Of these 14,000 British and 8,000 foreigners passed through to the United States, and the number that remained as permanent settlers in Canada was therefore 31,183. In addition there was an accession of 6,000 or 7,000 to the population of the province by persons arriving from the United States. The disposition to settle permanently in Canada is stated to have been stronger than at any former period. This is attributed partly to the depressed condition of business in the United States and partly to the effects of the Know-Nothing movement against foreigners. A body of 50 or 60 Norwegians, who have settled near Sherbrooke, are regarded as very valuable colonists, and a strong hope is entertained that they may be the means of attracting further arrivals.

Protection of Iron from Oxidation.—M. Paris has discovered a vitreous enamel, which will stand the test of any chemical or physical action to which it may be subjected. Some experiments fully prove that the adherence is perfect, and that the enamel resists the most violent shocks without cracking, although the iron it covers may be completely bent; it does not peel off or take fire by the action of heat; and concentrated acids can be kept at the boiling point for a considerable period in vessels protected by it. These qualities will enable the use of iron, where glass, silver, gold, or platina has only hitherto been employed. It is also proposed to apply the invention more especially to the lining of water and gas pipes, covering roofs, and sheathing ships, anchors, &c.—*Mining Journal.*

Errata.—Page 325—third line from bottom of first column—for "Vetutinus," read "Velutinus."

Page 325—second column, line 16—for "Thumb," read "Thunb."

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—July, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Direct.	Mean Vel'y	Rain in Inch.
1	29·448	29·337	—	—	70·7	79·1	—	—	—	0·584	0·657	—	—	·81	·68	—	—	S S W	SW b S	S S W	S 15 W	9·24	...
2	·392	·481	29·663	29·529	62·2	73·7	58·7	65·3	+ 0·3	·454	·449	·390	·433	83	56	·81	·75	S S W	S S W	NWbW	W 9 S	11·37	...
3	·760	·717	·536	·661	58·9	63·2	56·8	60·2	— 4·9	·398	·394	·399	·386	82	70	89	77	Calm	E b S	E N E	E 6 N	8·79	...
4	·454	·418	·525	·475	62·3	74·5	66·8	68·2	+ 2·9	·482	·549	·615	·511	88	67	81	76	E b N	S S W	NWbW	W 15 S	8·69	0·005
5	·688	·743	·776	·733	59·7	68·6	60·2	62·3	— 3·1	·387	·482	·444	·413	77	71	87	76	W b N	S b W	S S W	S 19 W	6·41	...
6	·713	·677	·675	·686	59·7	72·0	59·9	64·3	— 1·4	·420	·480	·375	·422	84	63	74	71	Calm.	S b E	N N W	N 16 W	6·55	...
7	·724	·744	·803	·758	56·0	68·0	54·2	59·9	— 5·8	·364	·394	·307	·336	83	59	74	67	N b W	S b W	NWbN	N 42 W	8·97	...
8	·815	·833	—	—	56·3	67·6	—	—	—	·338	·418	—	—	76	63	—	—	W N W	S S E	S S E	S 34 E	5·92	...
9	·759	·606	·509	·616	60·3	71·4	63·9	64·9	— 1·1	·472	·467	·487	·471	92	62	84	79	N E	S b E	S b W	E 9 S	8·01	·010
10	·527	·547	·623	·570	69·8	75·9	59·3	68·0	+ 1·9	·574	·575	·379	·488	81	67	77	73	N W	S b W	W b S	W 28 N	5·82	...
11	·612	·523	·497	·533	61·7	76·6	65·9	68·6	+ 2·5	·423	·556	·502	·496	78	62	81	73	W N W	S b E	S b W	S 25 W	5·49	Inap.
12	·481	·407	·386	·427	63·9	74·3	68 6	68·4	+ 2·1	·498	·614	·555	·554	86	74	82	82	S S W	S S E	E b N	S 15 W	4·07	·410
13	·385	·426	·525	·449	62·5	66·6	59·2	62·9	— 3·5	·511	·524	·362	·459	93	83	74	82	Calm.	S	N b W	N 36 W	6·27	·255
14	·625	·657	·653	·644	60·3	72·0	60·8	64·5	— 1·9	·382	·359	·333	·363	75	47	64	62	E S E	S	N E b E	S 41 E	5·05	...
15	·668	·698	—	—	64·3	75·0	—	—	—	·461	·605	—	—	78	72	—	—	N E bE	E b S	S S W	E 8 S	5·09	...
16	·764	·741	·729	·742	72·4	82·1	71·8	76·1	+ 9·5	·648	·711	·639	·675	84	67	84	78	N N W	S b W	S W	S 26 W	9·11	...
17	·711	·671	·695	·688	74·5	87·2	74·9	78·8	+12·1	·701	·700	·692	·689	85	56	83	74	S WbW	W b S	N N W	W 12 S	5·98	...
18	·723	·629	·532	·616	69·6	84·3	74·5	76·5	+ 9·8	·666	·762	·711	·713	95	67	87	81	Calm	S	S S W	S 19 W	8·41	...
19	·480	·427	·537	·492	75·9	88·4	72·1	79·4	+12·7	·751	·709	·559	·675	87	55	73	70	SWbW	W	N b W	W 28 S	13·08	·295
20	·700	·750	·744	·723	59·9	61·2	59·7	60·7	— 6·1	·487	·422	·410	·428	96	80	82	83	N E	E N E	N b W	N 28 E	6·17	·090
21	·754	·778	·774	·768	59·4	65·0	56·9	60·6	— 6·1	·427	·395	·342	·396	86	66	75	77	N b E	E	N N E	E 32 N	8·41	
22	·775	·731	—	—	61·7	65·6	—	—	—	·466	·478	—	—	87	78	—	—	N E	E	N E b E	E 16 N	6·20	·035
23	·721	·695	·721	·712	60·7	71·0	62·0	64·9	— 2·0	·465	·520	·496	·511	89	70	91	·86	N N E	S E	N E	E 2 S	4·55	·325
24	·706	·646	·654	·669	62.7	69·2	62·5	64·9	— 1·9	·478	·565	·513	·533	86	81	93	89	N N E	E N E	Calm	E 21 N	4·13	·065
25	·668	·670	·646	·661	66·9	71·8	67·5	68·7	+ 1·7	·584	·568	·596	·592	92	75	91	87	N	E S E	Calm	S 40 E	2·45	1·205
26	·594	·517	·513	·540	67·2	76·3	68·6	70·3	+ 3·4	·607	·749	·650	·662	93	85	97	92	N E b E	S b E	E b S	S 34 E	2·49	Inap.
27	·515	·451	·379	·454	70·4	79·5	70·5	73·4	+ 6·4	·603	·769	·652	·690	94	78	90	86	N b E	S b E	N E b E	S 43 E	6·63	·315
28	·387	·470	·513	·459	69·3	74·4	71·1	73·0	+ 6·0	·650	·733	·640	·665	94	89	86	85	S	NWb N	NWbW	W 2 S	4·23	·195
29	·575	·611	—	—	69·3	79·0	—	—	—	·597	·711	—	—	86	74	—	—	NW bN	S	E N E	N 26 E	5·33	·040
30	·623	·606	·619	·612	68·9	76·1	66·4	70·2	+ 3·2	·655	·675	·557	·622	96	77	89	87	N	S S E	N	E 24 S	4·00	...
31	·641	·683	·677	·672	67·1	74·9	68·6	71·6	+ 4·6	·575	·725	·511	·598	90	87	75	79	N E b E	S E b S	N N E	E 20 N	3·67	...
M	29·619	29·603	29·612	29·611	64·7	73·8	64·7	67·9	+ 1·7	0·525	0·571	0·504	0·530	·87	·70	·82	·79	4·33	9·23	5·14	S 19 W	6·47	3·245

Highest Barometer...... 29·833, at 2 p.m. on 8th } Monthly range:
Lowest Barometer....... 29·337, at 2 p.m. on 1st } 0·496 inches.

Highest registered temperature 92°·8, at p.m., 19th } Monthly range:
Lowest registered temperature 49°·2, at a.m. on 8th } 43°·6.

Mean Maximum Thermometer.............. 76°·75 } Mean daily range:
Mean Minimum Thermometer....... ...... 60°·05 } 16.70

Greatest daily range.........33°·0, from p.m. of 19th to a.m. of 20th.
Least daily range ....6°·2, from p.m. of 20th, to a.m. of 21st.

Warmest day....... 19th. Mean temperature......79°·45 } Difference,
Coldest day......... 7th. Mean temperature......59°·93 } 19°·52.

Greatest intensity of Solar Radiation, 108°·5 on p.m. of 19th } Range,
Lowest point of Terrestrial Radiation, 40°·2 on a.m. of 14th } 68°·3.

Aurora observed on 2 nights: viz. on 19th and 21st.
Possible to see Aurora on 19 nights. Impossible on 12 nights.
Raining on 13 days. Raining 36·6 hours; depth, 3·245 inches.
Mean of Cloudiness, 0·59. Halo round the Moon on 24th.
Thunder storms occurred on the 12th, 13th, 27th, and 30th.
Sheet lightning and distant thunder on 1st, 3rd, 9th, 11th, 15th, 18th, 25th, and 29th.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1363·51	1460·45	1876·87	1280·13.

Mean direction of Wind, S 19° W. Mean velocity 6·47 miles per hour.
Maximum velocity, 24·0 miles per hour, from 2 to 3 p.m. on 19th.
Most windy day, the 19th; mean velocity, 13·08 miles per hour.
Least windy day, the 25th; mean velocity, 2·45 " "
Most windy hour, 3 p.m.; Mean velocity, 9·98 miles per hour.
Least windy hour, 5 a.m.; Mean velocity, 4·32 " "
Mean diurnal variation, 5·66 miles.

The Mean Temperature of July, 1855, has been 1°·1 above the average of the last 16 years, and the 19th was the warmest day with two exceptions (July 12, 1845, and July 3, 1854) since the commencement of the Observations. The number of days on which Rain fell has been greater than in any previous July, but the quantity fallen has been 0·475 inch less than the average. The Mean Velocity of the Wind has been 2·11 miles per hour above the average of the last eight years, and the 19th was the most windy day in any July during the same period.

Comparative Table for July.

Year.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Wind. M'n Direc.	Mean Velocity in Miles.	
1840	65·8	—1·0	79·4	48·2	31·2	6	5·270	...		
1841	65·0	—1·8	86·3	43·2	43 1	10	8·150	...	0·27	lbs.
1842	64·7	–2·1	90·5	42·0	48·5	4	3·050	...	0·33	lbs.
1843	64·5	—2·3	86·1	40·2	45·9	8	4·605	...	0·44	lbs.
1844	66·0	—0·8	86·1	40·5	45·6	12	2·815	...	0·19	lbs.
1845	66·2	—0·6	94·6	45·6	49·0	7	2·195	...	0·30	lbs.
1846	68·0	+1·2	94·0	44·9	49·1	9	2·895	...	0·29	lbs.
1847	68·0	+1·2	87·5	43·8	43·7	8	3·355	...	0·19	lbs.
1848	65·5	—1·3	82·7	46·7	36·0	10	1·890	N 14 W	4·94	Miles.
1849	68·4	+1·6	89·1	51·0	38·1	4	3·415	S 5 W	3·52	Miles.
1850	68·9	+2·1	84·9	52·8	32·1	12	5·270	E 9 N	4·56	Miles.
1851	65·0	—1·8	82·7	52·1	30·6	12	3·625	W 30 N	4·13	Miles.
1852	66·8	0·0	90·1	49·5	40 6	8	4·025	W 45 N	3·33	Miles.
1853	65·6	—1·2	85·4	49·4	36·0	10	0·915	E 14 S	3·70	Miles.
1854	72·5	+5·7	93 6	53·0	40·6	9	4·805	W 32 S	4·26	Miles.
1855	67·9	+1·1	88·4	53·1	35·3	13	3·245	S 19 W	6·47	Miles.
									0·29	lbs.
M'n.	66·80		87·59	47·25	40·34	8.9	3·720		4·36	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——July, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 *deg.* 32 *min. North.* *Longitude*—73 *deg.* 36 *min. West.* *Height above the Level of the Sea*—118 *Feet.*

Day.	Barom. corrected and reduced to 32° Fahr. 6 A.M.	2 P.M.	10 P.M.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	Tension of Vapor. 6 A.M.	2 P.M.	10. P.M.	Humidity of Air. 6 A.M.	2 P.M.	10 P.M.	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity in Miles per Hour. 6 A.M.	2 P.M.	10 P.M.	Rain in Inches	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. 6 A.M.	2 P.M.	10 P.M.
1	29·656	29·600	29·580	76·1	92·2	77·9	·727	·814	·787	·82	·59	·86	W S W	S W	S S W	11·98	5·00	4·25	...	Str. 4.	Cirr. 2.	Nimb., dis. thun.
2	·590	·567	·801	74·2	81·0	68·3	691	607	552	83	58	81	S W b W	W S W	S W b W	5·26	12·12	8·02	0·343	Cum. Str. 9.	Do. 2.	Clear.
3	·998	·988	30·010	58·8	74·1	62·1	412	458	472	84	55	84	W	W b S	S W	10·28	6·50	0·62	...	Clear.	Clear.	Do.
4	·796	·718	29·685	69·2	78·5	66·0	513	670	584	72	71	91	S	S	S W	11·97	9·97	10·25	0·076	Cir. Cum. Str.	Cirr. Str. 8.	Cum. Str. 9.
5	·685	·814	·917	65·3	79·2	64·7	555	659	476	89	67	79	S W	S W	W b S	2·05	6·04	6·56	...	Clear. [4.	Do. 4.	Cir. Str. 4.
6	·954	·860	·853	68·1	82·7	63·8	496	597	516	72	55	89	S W b S	S W	S W b S	1·46	1·50	0·16	...	Cir. Str. 4.	Cir. Cum. Str. 6.	Str. 10.
7	·917	·946	30·000	60·2	65·1	54·3	416	381	349	79	61	81	N b E	N E	N E b N	5·37	5·20	1·52	...	Cir. Cum. Str.	Cum Str. 10.	Clear, ft. aurora.
8	30·073	30·040	30·060	52·1	76·6	60·1	326	515	441	81	58	84	N E b N	S W	S S W	5·00	2·47	0·87	...	Clear. [8.	Clear.	Cir. 2.
9	30·096	29·926	29·856	66·0	78·8	64·5	478	498	401	76	52	67	S S W	S S E	S b E	0·21	3·75	4·87	...	Do.	Cir. Str. 8.	Clear, ft. aurora.
10	29·706	·708	·734	66·3	74·7	72·3	516	648	638	80	78	82	S	W N W	W b S	8·16	4·98	0·66	Inapp.	Cirr. Str. 8.	Do. 4.	Cum. Str. 8.
11	·732	·695	·726	70·2	85·7	68·0	568	659	523	78	56	76	W b S	W S W	W S W	0·11	1·56	3·25	...	Clear.	Do. 4.	Clear.
12	·694	·646	·676	69·8	87·7	70·1	541	638	628	76	51	86	W S W	S W	W S W	1·23	4·20	2·60	...	Cirr. 2.	Cir. Cum. Str. 8.	Cir. Cum. Str. 4.
13	·604	·599	·612	65·1	64·0	61·0	555	534	521	89	89	97	S W b S	W	N W	0·10	7·50	1·32	0·430	Cir. Cum. Str.	Rain, thun. stor.	Str. 4.
14	·817	·836	·912	63·1	76·0	62·9	488	471	499	84	53	90	W b N	W	S S W	Calm	0·89	8·29	...	Clear. [4.	Clear.	Clear.
15	30·001	·982	·994	69·0	88·6	71·0	513	619	617	72	·51	82	S S W	S	S	0·09	1·50	6·80	...	Cirr. 4.	Cir. 4.	Do.
16	29·986	·925	·915	74·2	90·1	75·9	620	814	739	75	·59	86	S	S W b W	S W b S	5·27	5·93	8·37	...	Clear.	Cir. Cum. 2.	Do., v. f. Aur. B.
17	·833	·809	·853	77·1	75·2	71·6	648	814	715	71	90	95	W b S	W S W	S W b W	0·01	10·71	2·20	0·770	Do.	Rain, thun. stor.	Cir. Str. 4.
18	·887	·823	·715	66·1	87·0	76·8	544	704	727	85	56	82	N W b N	S S E	S W b W	0·26	1·81	2·52	...	Do.	Cir. Cum. 2.	Str. 2.
19	·567	·509	·651	75·0	80·4	66·0	764	787	501	89	78	79	S W b W	W N W	N b W	6·44	10·30	6·77	0·499	Str. 8.	Cum. Str. 6, thu.	Str. 4.
20	·960	·934	30·001	60·0	76·0	60·7	371	517	467	71	59	89	N N E	N E b E	S E b E	9·11	4·81	0·07	...	Cirr. Cum. 4.	Cir. Cum. Str. 4.	Do. 6.
21	30·010	·983	30·001	54·9	74·4	59·2	373	435	452	87	52	89	E b N	N E b E	E	1·28	5·90	1·25	...	Do. 6.	Cir. Str. 2.	Clear.
22	30·051	·967	29·999	60·3	80·1	65·1	416	617	499	79	61	80	E	S S E	S S E	Calm	0·63	0·27	...	Clear.	Cir. Cum. Str. 4.	Cum. Str. 6.
23	29·958	·959	30·015	63·9	78·7	64·1	546	578	534	94	61	89	S S E	S	S	3·28	Calm	1·40	...	Str. 9.	Cir. Cum. 8.	Light Cum.*
24	·999	·911	29·879	66·2	82·7	67·8	574	659	593	89	61	89	S	S	S S E	Inap.	1·12	1·62	...	Very dense fog	Cum. Str. 9.	Cir. Cum. Str. 8.
25	·862	·826	·839	65·0	88·7	71·8	560	801	648	90	62	86	S S E	S W	S W b W	Calm	1·02	3·31	...	Fog.	Do. 4.	Str. 2.
26	·821	·811	·706	70·0	89·2	71·5	659	751	715	90	56	98	S W b W	S W	S W b S	Calm	1·79	0·15	...	Cirr Str. 8.	Cir. Cum. Str. 10	Rain.
27	·755	·724	·775	72·1	88·9	72·8	704	638	704	90	46	90	N W	S b W	S b W	Calm	0·15	0·30	0·233	Clear.	Cum. Str. 2.	Clear.
28	·690	·701	·714	69·9	90·1	73·6	668	617	692	95	45	86	S b W	S b W	S	0·37	Calm	7·87	...	Cirr. 4.	Cir. Cum. Str. 8.	Cum. Str. 4.
29	·710	·740	·828	76·0	82·4	70·6	661	763	692	76	71	95	S	W b S	W N W	2·25	3·38	2·15	...	Cir. Cum. Str.	Cum. Str. 8.	Clear.
30	·832	·826	·734	69·2	82·0	70·2	668	692	628	95	64	86	N W b W	N W b W	N W b N	Calm	0·62	0·19	...	Do. 4. [8.	Cir. Cum. Str. 4.	Str. 8.
31	·866	·838	·889	69·5	89·0	70·2	486	588	628	69	44	86	N N E	E	N E b N	0·15	6·32	Calm	...	Clear.	Cir. Str. 4.	Do. 4.

Barometer ....
- Highest, the 9th day .... 30·096
- Lowest, the 19th day .... 29·509
- Monthly Mean .... 29·803
- " Range .... 0·587

Thermometer
- Highest, the 28th day .... 94°·8
- Lowest, the 8th day .... 42°·2
- Monthly Mean .... 72°·73
- " Range .... 52°·6
- Mean Humidity .... ·757

Greatest Intensity of the Sun's Rays .... 127°·2
Lowest Point of Terrestrial Radiation .... 40°·1
Rain fell on 7 days, amounting to 2·351 inches, raining 14 hours 5 min.; and was accompanied with thunder on four days.
Most prevalent Wind, S. Least prevalent Wind, S b E.

Most Windy Day, the 4th day; mean miles per hour, 10·72.
Least Windy Day, the 27th; mean miles per hour, 0.15.
Aurora Borealis visible on 3 nights. Might have been seen on 11 nights.
Lunar Halo on the 23d, diameter 38°·0.
Splendid Meteor on the 14th, at 9-10 p.m., passing from α Aquila to ε Serpentis; motion slow, and leaving a train like a rocket, noiseless.

The electrical state of the atmosphere has been marked by a moderate intensity of a positive character; and during the storms of the 15th and 17th days indicated a very high tension of negative electricity, amounting to 300° in terms of Volta's Electrometer No. 1.—0·770 inches of rain fell in 18 minutes during the storm of the 17th day.
Ozone.—The amount of Ozone has been in moderate quantity during the month.

* Lunar Halo, diameter 38°.

Monthly Meteorological Register, Quebec, Canada East, July, 1855.

BY LIEUT. A. NOBLE, R. A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 *deg.* 49·2 *min. North; Longitude,* 71 *deg.* 16 *min. West. Elevation above the level of the Sea,—Feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Tension of Vapour.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·511	29·436	29·410	29.452	59·1	89·6	77·7	75·5	0·420	0·744	0·596	0·587	86	57	65	69	S S W	W b N	W S W	2·0	8·8	5·2	·145	...	
2	·495	·405	·507	·469	69·8	81·2	66·4	72·5	·621	·620	·495	·579	88	60	78	75	N N E	W S W	W S W	3·8	14·3	16·0	·178	...	
3	661	·819	·876	·785	66·4	70·2	62·0	66·2	·396	·336	·396	·374	63	47	74	61	W N W	W S W	N	12·4	13·4	2·0	...	...	
4	·836	·685	·534	·685	62·3	73·4	66·6	67·4	·387	·495	·552	·478	71	61	87	73	E N E	S S E	S S E	11·3	11·3	8·8	·488	...	
5	·608	·655	723	·662	67·1	72·9	67·4	69·1	·562	·467	·421	·483	87	60	64	70	W S W	W S W	W S W	10·0	12·4	3·8	...	...	
6	·797	·739	·706	·747	61·2	77·7	66·6	68·5	·429	·419	·427	·425	82	46	67	65	Calm.	W S W	E N E	0·0	7·2	13·4	...	...	
7	·698	·747	·845	·763	64·4	68·2	59·1	63·9	·418	·393	·311	·374	71	59	64	65	W S W	E N E	E N E	3·8	17·9	25·4	...	...	7th. At 2 p.m. circle round sun 35° in diameter.
8	·867	·864	·902	·878	55·7	68·1	58·7	60·8	·268	·274	·296	·279	62	41	61	55	N	E	N W	3·8	7·2	3·8	...	...	
9	·978	·853	·724	·852	56·4	75·1	66·7	66·1	·326	·326	·372	·341	64	38	58	53	S	E	E	5·2	6·2	3·8	...	...	9th. At 10 p.m. bright Auroral arch and Streamers.
10	·621	·581	·529	·577	61·3	73·9	64·9	66·7	·407	·552	·350	·436	77	68	92	79	Calm.	S S W	Calm.	0·0	6·2	0·0	...	...	
11	·549	·553	·622	·576	61·0	72·2	64·8	66·0	·468	·431	·534	·478	90	56	89	78	N W	E N E	W	2·0	11·3	8·0	...	...	
12	·562	·503	·503	·523	66·8	81·0	70·9	72·9	·511	·420	·471	·467	80	42	64	62	S S W	W S W	S W	8·6	8·0	2·0	·066	...	
13	·499	·355	·395	·416	66·8	71·5	60·2	66·2	·467	·602	·446	·505	73	81	87	80	Calm.	Calm.	N W	0·0	0·0	8·8	1·346	...	
14	·603	·688	·799	·697	58·0	72·0	61·1	63·7	·330	·340	·401	·357	70	63	77	70	W N W	N W	Calm.	8·8	7·2	0·0	...	...	
15	·929	·908	·891	·909	58·4	80·0	71·2	69·9	·386	·446	·506	·446	81	46	68	65	Calm.	S	W	0·0	3·8	3·8	...	...	
16	·904	·799	·705	·803	69·2	82·0	77·0	76·0	·497	·612	·696	·602	72	58	77	69	S	W	W	5·2	12·4	7·2	...	...	
17	·761	·516	·655	·667	74·8	68·1	70·9	71·3	·685	·633	·666	·661	82	95	91	89	W S W	W	N W	13·4	7 2	5·2	·686	...	
18	·754	·676	·485	·638	64·7	75·2	70·0	70·0	·429	·416	·589	·478	73	49	83	68	E N E	S	S	15·2	2·0	2·0	·190	...	
19	·313	·312	·580	·402	72·9	76·9	63·5	71·1	·698	·734	·376	·603	89	82	66	79	S W	W N W	N W	13·9	8·8	7·2	·718	...	17th. Heavy squall, wind varying in velocity from 50 to 30 miles per hour.
20	·727	·793	·853	·791	58·6	69·3	59·7	62·5	·431	·226	·293	·317	90	33	59	61	N W	N W	N N W	13·4	14·7	8·0	...	...	
21	·895	·831	·724	·817	56·4	71·6	62·5	63·5	·268	·329	·316	·304	60	43	57	53	W N W	E	W N W	8·0	8·0	10·0	...	...	
22	·910	·841	·800	·850	55·4	75·5	66·9	66·0	·394	·270	·401	·355	92	32	62	62	S S E	N W	S W	7·2	8·0	2·0	...	...	19th. Brilliant Aurora.
23	·814	·778	·781	·791	68·9	72·2	66·5	69·2	·473	·457	·519	·486	69	60	83	71	N W	N N W	N W	2·0	10·0	2·0	...	...	
24	·822	·744	·692	·753	64·8	78·5	69·9	71·1	·476	·469	·536	·494	80	50	76	69	N N W	N W	S	6·2	6·2	11·3	...	...	
25	·677	·586	·597	·620	64·8	82·7	73·2	73·6	·520	·560	·610	·563	87	52	78	72	N N W	N W	W S W	5·2	8·0	5·2	·039	...	
26	·672	·624	·556	·617	66·5	74·6	69·5	70·2	·358	·436	·430	·408	57	53	62	57	E	N E	E N E	8·0	5·2	2·0	inap.	...	
27	·568	·591	·608	·589	64·7	73·6	64·5	67·6	·414	·410	·435	·420	70	51	74	65	E N E	E	E	7·2	10·0	8·0	...	...	
28	·597	·562	·562	·574	64·0	82·1	72·9	73·0	·492	·668	·682	·614	85	63	87	78	E N E	S W	Calm.	3·8	3·8	0·0	·135	...	
29	·583	·580	·585	·583	68·0	71·4	70·4	69·9	·504	·668	·691	·621	76	90	97	88	S	E	E S E	3·8	3·8	9·3	·396	...	
30	·631	·664	·671	·655	69 0	76·8	70·0	71·9	·564	·497	·527	·529	82	56	75	71	Calm.	E	E	0·0	5·2	8·0	...	...	
31	·693	·692	·765	·717	66·3	81·3	70·0	72·5	·498	·388	·479	·455	79	38	68	62	N	E	N E	8·0	10·9	11·3	...		
M	29·695	29·664	29·660	29·6728	63·99	75·45	67·15	68·86	0·455	0·472	0·478	0·468	77	56	71	69				6·20	8·37	6·56	4·327		

Maximum Barometer, 6 a.m. on the 9th .... 29·978
Minimum Barometer, 2 p.m. on the 19th .... ·312
Monthly Range .... ·666
Monthly Mean.......... 29·6728
Maximum Thermometer on the 1st .... 90°·3
Minimum Thermometer on the 21st.......... 51·9
Monthly Range .... 38·4
Mean Maximum Thermometer .... 80·02
Mean Minimum Thermometer .... 59·98
Mean Daily Range 20 04
Mean Monthly Temperature.......... 68·86

Greatest Daily Range of Thermometer on 1st .... 31°·2
Least Daily Range of Thermometer on 29th .... 8°·2
Warmest Day, 16th. Mean Temperature .... 76·0
Coldest Day, 8th. Mean Temperature .... 60·8
Climatic Difference.......... 15·2
Possible to see Aurora on 17 Nights.
Aurora visible on 14 Nights.
Total quantity of Rain, 4·327 inches.
Rain fell on 12 days.
No Snow fell.

The Canadian Journal.

TORONTO, OCTOBER, 1855.

Hints for the Formation of a Canadian Collection of Ancient Crania.

The value which attaches to ancient skulls as indices of the characteristics of extinct races, is being more and more generally appreciated with the increasing results of extended observation. Camper, the originator of the ideal facial angle, was the first of modern scientific craniologists who aimed at establishing a system of classifying races by means of cranial conformation; and with him must be noted Daubenton, the contemporary and fellow-labourer of Buffon, who first drew attention to some of the most remarkable elements of comparison, in the characteristics of the base of the skull, both in comparative anatomy, as between the ape and man, and between the known races of men, as the Negro and European. These were followed by Blumenbach, to whom we owe the accepted application of some of the most familiar ethnological terms, such as Mongolian, Ethiopian, and, above all, *Caucasian*. Of these the last was undoubtedly founded on error, and, as now commonly employed, has a falser and more misleading import than any it was designed to convey by its originator. Hunter, Cuvier, and other naturalists, more or less incidentally noticed the same elements of comparison, and Dr. Prichard, with a rare combination of learning and powers of observation, began so early as 1808, by the publication of his *De Hominum Varietatibus*, a series of works which have exercised the most important influence on the science of Ethnology.

While the latter of these works were in progress, a distinguished American physiologist, Dr. Samuel George Morton of Philadelphia, devoted himself to craniological investigation with a special view to the elucidation of the many obscure points relative to the ancient and existing native races of the new world. The first task he proposed to himself was the examination and comparison of the crania of the Indian tribes of North and South America. In following out his investigation he enlisted many zealous coadjutors in his service, and obtained skulls from ancient Mexican and Peruvian sepulchres, and from the grave mounds of the Southern States and of Central America. The first fruits of this was the publication, in 1839, of his *Crania Americana*, a work of the utmost value in this department of physical ethnology. Dr. Morton next proceeded to extend his labours into the most ancient areas of human colonisation, and with the aid of Mr. G. R. Gliddon, the United States Consul at Cairo, in Egypt, he obtained an important collection of skulls from the venerable catacombs of the Nile valley. The result of this was the publication of another work, the *Crania Ægyptiaca*, in 1844, which met with the highest commendations from the Archæologists and Ethnologists of Europe. Dr. Morton's death took place in 1851, while engaged in the prosecution of researches calculated still further to elucidate the science to which he had already made such valuable contributions. The extensive collection of crania which he had made, including those which furnished the data for the two great works named above, has since been purchased from his widow and added to the Cabinet of Natural Sciences of Philadelphia.

European Ethnologists have not failed to appreciate the importance of such observations, and valuable collections of ancient crania are now to be met with in Paris, Stockholm, Copenhagen, Edinburgh, and other European capitals. Especial attention has more recently been directed to the subject in Britain, and a work is now projected by Joseph Barnard Davis, Esq., and Dr. John Thurnam, after the model of Dr. Morton's *Crania Americana*, specially devoted to the illustration of the Ethnology of Great Britain and Ireland by means of " delinia-tions of the skulls of the aboriginal inhabitants of the British Islands, and of the races immediately succeeding them."

The following extract from the prospectus of this work, which is to bear the title of *Crania Britannica*, will suffice to show the aim of its authors, and the nature of the truths they hope to elucidate :—

" Amid an attention to the Natural History of Man, such as has never before been excited, embracing the inhabitants of every region and remote island of the globe, it seems an anomaly, that the people who first roamed the wilds and forests of our native country should have hitherto attracted so little regard. There have been many controversies to decide the exact position held by the ancient Britons in the scale of civilization. Antiquaries have appealed to the numerous relics of their arts, and history adduces evidences of their prowess, their patriotic valour, and of their heroic resistance of even Roman conquest. Their remaining works have been traced out and deciphered with the most patient investigation. But it is remarkable, that their personal remains—their bones,—entombed in Barrows over so many districts of these islands, have, until recently, not been objects of attraction even to collectors;—unlike the geologist, who has gathered up and treasured every osteological fragment of the races of animals coming within his domain. Hitherto no publication has been devoted to the chief vestige of the organization of the primitive Briton and his successors, that most important and instructive of all—his Cranium. In the skulls themselves, we have the very "heart of heart" of all their remains, which the gnawing " tooth of time and razure of oblivion" have spared. These present an exact measure of their differing cerebral organization, of their intellect and feelings; and may be said to be impressed with a vivid outline of their very features and expressions.

It is believed that a sufficient number of these precious relics have now been exhumed from Barrows and other Tombs, in which the living hands of their brethren (observing the dictates of eternal love, or the rites of an all-pervading superstition, based in inextinguishable aspirations) deposited them, to enable us not merely to reproduce the most lively and forcible traits of the primæval Celtic hunter or warrior, and his Roman conqueror, succeeded by Saxon or Angle chieftains and settlers, and, later still, by the Vikings of Scandinavia; but also to indicate the peculiarities which marked the different tribes and races who have peopled the diversified regions of the British Islands; and as we thus picture our varied ancestry, to deduce, at the same time, their position in the scale of civilization by the tests of acurate representation and admeasurement.

These primitive remains are of great interest—of real national value,—and deserve the most careful examination and study, that they may be delineated with the utmost precision—with artistic skill worthy of the subject; and, being thus perpetuated, they will be rescued from the grasp of accidental destruction, and the further inroads of fretting age.

In some countries of Europe, collections of Crania, such as are above alluded to, have thrown much light on the history and relations of the early races inhabiting them. The results obtained from researches of this kind in the Scandinavian kingdoms, have been presented to the world in the writings of Eschricht, Retzius, and Nilsson. In America, the great master of the science, the late Professor Morton, founded his classical works on the Aborigines of the Western World and the ancient Egyptians, upon skulls obtained from the mounds and burial-places of the former, and the Catacombs of the land of the Pharaohs. In our own country, as Dr. Prichard, our best ethnological authority, repeatedly laments, nothing of the kind, except on the most inadequate scale, has yet been attempted. Few countries, however, present greater facilities for an inquiry of this description."

The authors accordingly propose to issue this work by subscription, in six parts of an imperial quarto size, each contain-

ing ten lithographic plates, accompanied with a descriptive narrative, giving the history of each exhumation, an account of any antiquities disinterred with it, and also, when necessary, illustrations of such, along with exact measurements of the skulls, similar to those furnished by Dr. Morton. The collections of the Society of Antiquaries of Scotland, the Phrenological Society of Edinburgh, the Royal Academy of Dublin, and of various other scientific bodies, have been placed at the service of the authors, and both the Royal Society of London and the British Association for the advancement of Science have granted pecuniary aid towards the requisite investigations.

When the importance of such evidences of the physical characteristics both of extinct and living races, in relation to historical investigation, is thus becoming so widely appreciated, it appears to be desirable that Canada should not lag behind in the good work. Such a collection of native Crania as that with which Dr. Morton has enriched the Cabinet of the Academy of Sciences of Philadelphia, would form a valuable addition to the museum of the Canadian Institute, and many facilities undoubtedly exist for its attainment. Every year agricultural operations are extending into new districts, and breaking up virgin soil. In the progress of clearing the ancient forests, and bringing the land into cultivation, places of sepulture must frequently be invaded, where the remains of the long-buried chief lie undisturbed, alongside of specimens of the rude arts which furnish proofs of the condition of society to which he belonged. Railway and other operations are in like manner leading to numerous extensive excavations in regions hitherto untouched by the spade or plough; and these also must frequently expose to view similar relics of the ancient or more recently displaced aborigines. It is scarcely to be hoped that the rude railway navvy, or even the first agricultural explorers of the wild lands of the North and West, will greatly interest themselves in objects of scientific curiosity; but now that the members of the Canadian Institute are scattered over nearly every district of the Province, it may be hoped they will be found prepared for hearty coöperation in all such objects, and that by such means the museum of the Institute may become, through time, an object of just pride and interest to the community at large.

In many cases the condition in which the skulls and other remains of the former occupants of our Canadian clearings are found, is such as to present no obstacle to their ready transmission for the purpose in view. It is to be noted, however, that the more ancient such remains are, they are likely to possess the greater interest and value. No indications have yet been noticed of a race in Canada corresponding to the Brachy-kephalic or square-headed mound builders of the Mississippi, and the discovery of such would furnish an addition of much importance to our materials for the primeval history of the Great Lake districts, embracing Canada West. Such remains, if found at all, are likely to be in a very fragile state, and will require much care in their removal. As it is not to be doubted that zealous coöperators in the object here referred to will be found among the members of the Institute, it may not be altogether useless to add a few hints relative to the collecting and preserving such ancient remains. It is not to be overlooked indeed, that the entire skeleton, as well as the skull, frequently presents features of interest and value, as evidence of peculiar distinctions of race, or as traces of habits and conditions of life, to those who have made such remains their special study. It is manifestly, however, only under very rare and peculiar circumstances that it can be expedient or even desirable to have the entire skeleton preserved. But the decision of this point must be left to each explorer.

In the first place then, let it be noted that it is desirable to possess the whole of the bones of the head and face, including the lower jaw and the teeth. The slender and fragile bones of the nose are of special importance, and when remaining in their place should be carefully protected from injury. In all cases they are highly characteristic, and in none more so than in the races of American Indians, whose strongly marked profiles derive their chief character from the prominence and peculiar form of the nose. It is also to be observed in the case of remains found under circumstances indicative of great antiquity, and consequently possessing peculiar value for the purposes in view, that though the bones may be wholly disjointed and even fractured, if the whole, or the greater number of the fragments be collected, and carefully packed so as to protect them from further injury, it may be quite possible to rejoin them, and so reconstruct the ancient cranium. The following incident derived from the experience of Dr. Morton, may suffice as an illustration of this :—

In the summer of 1842, a friend of his met in New York the well known American traveller, Mr. John S. Stevens, then recently returned from his second visit to Yucatan. The conversation turning upon Crania, Mr. Stevens regretted the destruction of all he had collected during his travels in consequence of their extreme brittleness. One skeleton he had hoped to save, but on unpacking it that morning, it was found so dilapidated that he had ordered it to be thrown away. A sight of it was immediately requested,—it was secured in its fragmentary and apparently hopeless condition, and forwarded to Dr. Morton. Its condition may be inferred from the fact that the entire skeleton was tied up in a small handkerchief, and carried from New York to Philadelphia in a hat-box. The next day, however, Dr. Morton was found with a gluepot beside him, industriously engaged in an effort to reconstruct the skull. A small piece of the occiput served as a basis, upon which he put together all the posterior portion of the cranium, showing it by characteristic marks to be that of an adult female. From the condition of another portion of the skeleton he derived evidence of a pathological fact of considerable moment, when viewed in relation to the antiquity indicated by the accompanying relics, and the peculiar circumstances under which this skeleton had been found; and the results of his observations, which have been published by Mr. Stevens in the narrative of his second visit to Yucatan, suffice to show how much interesting and valuable information may be deduced by the intelligent student of science from what, to the ordinary observer, would appear to be a mere handful of rubbish.

In Canada it is to be presumed that, in the great majority of cases, such remains will be discovered by chance, and their preservation from further injury in the hands of their original exhumers will be more a matter of accident than design. By and by, however, we may hope to create an intelligent interest in this department of scientific inquiry, and so find zealous explorers of the sepulchral chronicles of Canada, as well as of those of Egypt, Britain, or Central America. To such, a few additional hints may be of value.

Whether it be a grave-mound, ossuary, or cemetery, that is being explored, the ruder instruments of excavation, such as the pick-axe and spade, should be laid aside as soon as any portion of a skull or skeleton has been exposed. The whole must then be cleared from the surrounding earth by means of

some light implement, such as a garden trowel, with the assistance of the hand. In removing the earth strict attention should be paid to any small objects contained in it : as the practice of the Indians of this continent, as well as of most other savage races, of burying weapons, implements, and personal ornaments with the dead is well known. The better to avoid any injury to the more essential parts, it is advisable, where it can be done without great inconvenience, to pursue the final process of laying bare the skeleton, by proceeding from the feet towards the head. The bones ought not to be attempted to be removed from the inclosing soil when they indicate the slightest fragility, until the earth has been cautiously removed all round them, so as to admit of their being lifted out. Where the skull has been fractured, or any of the bones of the face are crushed or displaced by the pressure of the earth, every fragment, however small, should be carefully collected ; and if the soil has been damp, or the bones are rendered soft by moisture, they should be exposed to the sun, before being wrapped up in paper.

Care should also be taken to note all the circumstances attendant on the discovery, which are likely to throw any light on the characteristics of the race, their mode of sepulture, or their arts, customs, or habits. Nothing should be trusted to memory, but all the facts noted at the moment and on the spot. Some of the most important of the facts to be observed and noted down are : The position of the body, whether lying at full length, on the back or side, or with the knees bent or drawn up ; also the direction of the body, and position of the head in relation to the points of the compass.

Next the nature and relative position of any relics, such as urns, implements, weapons, &c., should be carefully noted ; and among such, particular attention is to be paid to animal remains, such as the bones and skulls, horns or teeth, of beasts, birds and fishes. It is a common fashion among savage tribes to hold a burial feast over the grave of the dead, and such relics may tend to throw considerable light on the habits of the people, as well as on the period to which they belong.

In transmitting ancient skulls, they should be first wrapped up in paper,—an old newspaper will be found the most suitable for the purpose. Where there are detached pieces each should be put up in a separate wrapper. The whole may then be put in a box with a little hay, which furnishes an inclosure sufficiently elastic to protect the most fragile bones from injury during carriage.

As such relics loose much of their value when the locality and circumstances of their discovery are unknown, it is extremely desirable not only to attach to each skull, package of bones, or accompanying relics, the name and description of the locality where they have been found, but also as soon as possible to mark this neatly and indelibly upon the object itself. Where more than one skull has been procured, and any of them are in a fragmentary state, it is scarcely necessary to add that the utmost care should be taken to keep the several portions of each skull distinct from the others ; as even where it may be possible afterwards to separate them, this must always be attended with much additional labour, and generally with some uncertainty. It may be further added that in no case should a skull, or other relic of this class, be deposited finally in a collection, without a distinct note of the locality of its discovery being marked on it in a durable manner.

D. W.

On the Extent to which the received Theory of Vision requires us to regard the Eye as a Camera Obscura.

BY GEORGE WILSON, M.D., F.R.S.E.

Director of the Industrial Museum of Scotland, and Professor of Technology in the University of Edinburgh.

In the last issue of the Transactions of the Royal Society of Edinburgh,* a highly interesting paper bearing the above title furnishes views on the structure and function of the eye in relation to vision, which will tend to modify to a very considerable extent the views of physiologists on this important subject. Dr. Wilson takes it for granted that, according to the received theory of vision, the eye of man, as well as that of most of the lower animals, is regarded as essentially realizing, during the performance of its function of sight, the condition of a darkened chamber, or *camera obscura.* In support of this assumption of the existing views of physiologists, he cites one of the highest living authorities, Professor Müller, and then proceeds to say :—" Thus far, then, there does not appear to be room for two opinions concerning the internal darkness of the human eye being a condition of perfect sight. But recent discoveries require us to look at the theory of vision from an opposite point of view. It is now beyond question, that even in the darkest human eye, there is reflection through or across its chamber, from the surface of the retina, as well as from that of the choroid ; and the observation is a very old one, that in a large number of animals, a part, and sometimes the whole of the retinal surface is covered, or replaced by a reflector rivalling in brilliancy a sheet of polished silver.

" That the eyes of living men and women emitted light, and shone like those of the cat, had been occasionally noticed and recorded from an early time, but the phenomenon was supposed to be an exceptional, and indeed very rare one, and was either credulously magnified into a highly marvellous occurrence, or despised as of questionable accuracy, and of little real significance. In (or about) 1847, however, Mr. Cumming, an English medical practitioner, pointed out that the phenomenon in question might be witnessed in every human eye, if looked for in the right way ; and a little later and independently, Brücke made the same discovery in Germany, through the curious circumstance, that occasionally when looking through his spectacles, at the face of another, he saw his neighbour's eye glare like a cat's.

" The demonstrability of the proposition, that the eye is not a camera obscura, depends upon the fact, that when rays of light enter the eye, and fall upon its back wall, as many of them as are reflected from the retina, or from the choroid behind it, will exactly retrace their course, and pass out through the pupil to the luminous body or illuminated object from which they came. Thus the diverging rays of a gas-flame are converged by the refracting media of the eye, to a focus upon the retina, where they unite to produce a picture, and thereafter in great part traverse that membrane and fall upon the choroid. If from either of these membranes rays are reflected (and for the sake of simplicity, we may, for the present, limit ourselves to the retina, which is the more powerful reflector of the two), they will follow in a reversed direction, the very course which they took in reaching that membrane, and return to the gas-flame, producing there an image of the picture on the retina, so that the reflected image of the flame is placed upon, and coincides in size and position with the actual flame.

* Transactions of the Royal Society of Edinburgh, Vol. XXI., Part II.

To see, therefore, into the deeper chambers of a living eye, we must arrange matters so that we can look along the straight line of the reflected rays, without intercepting the light from which they originally came.

"The experiment is thus made :—'In a dark room, with a single flame at the side of the experimenters, and on a level with their eyes, the person whose eye is to be observed holds a piece of glass (a microscope glass slip), so as to catch the image of the flame on it; he then, by inclining the glass, brings the image of the flame opposite the pupil of the observer's eye ; the latter will then see the pupil of the observed eye luminous, of a reddish-yellow bright colour. . . . . A person may also see one of his own pupils luminous : standing before a looking-glass, and seeing the image of the flame in the reflector with his *right* eye, let him bring this image opposite the pupil of the left eye in the looking-glass ; the left eye will then perceive the right pupil in the mirror luminous.'"

Various German physiologists have invented instruments called ophthalmoscopes, for the purpose of viewing the reflected light from the retina. It appears, however, that the choroid as well as the retina is a reflector of light, and thus deprives the eye of the character of a camera obscura. Yet, notwithstanding these facts, which cannot fail to have been for some time noticed by physiologists, Dr. Wilson is not aware that any material alteration in the current theory of vision has been proposed by any writer. With respect to Albinos he observes :—

"It cannot then, I think, be questioned, that in those animals which exhibit the full development of long hereditary albinism, the sensitiveness of the retina to light has undergone a permanent abatement, whilst the iris has probably altered also in thickness and contractility. I venture to predict, that if ever an albino race of men shall be observed or developed, they will prove, after the lapse of a generation or two from their founders, to have eyes as serviceable as those of the majority of mankind.

"It is sufficient for my present purpose to point to the albino animals, whose eyes are totally destitute of pigment, and reflect light from every point of the surface, both of the retina and the choroid, but, nevertheless, exercise the faculty of sight in perfection. Their eyes, even when the iris is fully contracted, remain, in virtue of the transparency of that membrane, *cameræ lucidæ;* their possessors cannot render them *cameræ obscuræ;* and yet they are excellent organs of vision.

"If the reasoning pursued in reference to the albino eye be valid, it will serve also to dispose of the difficulty experienced by some in explaining how vision is compatible with the presence of a *tapetum lucidum* in the eyes of many animals. This tapetum is equivalent to a concave mirror of polished metal, replacing the pigment of the choroid over a greater or smaller part of its surface, especially at the deepest or most posterior portion of the chamber of the eye, so that lying behind the retina, it is more or less directly opposite the pupil, and receives the light which enters by it. A brilliant reflecting surface of this kind is found in many of the mammalia, both graminivorous and carnivorous, as the horse, the ox, the sheep, the cat, the dog. It is present in the eyes of the whale, seal, and other marine mammalia ; and in fishes, such as the shark, in which it is peculiarly brilliant. It occurs also in certain of the mollusca, as the cuttle-fish ; in certain insects, as the moths ; but never, I believe, in birds. It is most largely developed in animals which are nocturnal in their habits, or live like fishes in a medium which is dimly illuminated. All must be familiar with the glare of light which it throws from the eye of the cat or dog, when these animals exhibit dilated pupils in twilight.

"This *tapetum lucidum*, has been a great stumbling block to physiologists. The albino eye was set aside as abnormal ; and the reflection of light in normal eyes from the retina and choroid was overlooked, or regarded as accidental, but that from the tapetum could not be. Most writers, however, dismiss it with an unsatisfactory and very brief comment, unable evidently to reconcile its presence with the maintenance of that internal darkness of the eye, which is supposed to be essential to vision."

In presenting a resumé of the whole question, Dr. Wilson enumerates many curious facts relating to vision and its object, the following extracts furnish as condensed a view of this extremely interesting subject as we feel warranted in giving :

It thus appears that the laws of luminous reflection do not necessitate imperfect vision, as applied to the fact, that the retina and choroid return much of the light which reaches them, for :—

1*st*. In the normal and also in the albino vision of all animals, man included, the amount of direct retinal and choroidal reflection is necessarily coincident with the width or degree of dilatation of the pupil ; the larger the pencil of light entering the pupil, the larger the pencil leaving it, so that in every case the reflected rays are thrown out of the eye and do not disturb vision : further,—

2*nd*. In those animals provided with *tapeta lucida*, such as the cat, the dog, or the ox, which are only partially nocturnal in their habits, the tapetum is so placed that in bright light it is not opposite to the contracted pupil, or is so only to a small degree. When, however, the choroidal mirror is called into action in twilight, the pupil is correspondingly dilated, and all the light which the tapetum reflects finds a free passage for its escape.

3*d*. In the eye of man, as well as in that of a large number of other animals, the background of retina and choroid on which the image is depicted, is not the darkest portion of the ocular screen, nor even so dark as those parts of the inner walls of the eye on which objects are never figured. On the other hand, as John Hunter has shown, and illustrated by existing specimens, the front and the anterior sides of the eye-chamber are the darkest, so that the reflecting power is greatest at the bottom of the eye.

4*th*. In the human eye, where, more than in those of the lower animals, it has been contended that the conditions of a camera obscura must be realised, the place of perfect vision, instead of being additionally darkened, is occupied by the well-known *yellow spot*, which has a marked reflective power, and is easily discerned by ophthalmoscopes.

The results which are announced in the preceding argument may be summed up as follows :—

1. The total absence of pigment from the choroid, the ciliary processes and the iris is compatible (especially where this condition is hereditary) with perfect vision.

2. The replacement of the pigment of the choroid lining the bottom of the eye by a concave mirror (*tapetum lucidum*) powerfully reflecting light, characterizes animals whose vision is very acute.

3. The non-tapetal or mirrorless eye of man, and of many animals, differs only in degree from the tapetal or mirrored eye of others ; for the retina and choroid act as a tapetum, and reflect light in the same way.

4. The eyes of vertebrate animals are only to a limited extent *cameræ obscuræ*, and internally are least dark in the portions most directly exposed to the action of light, and where the seat of perfect vision is placed.

5. The back of the iris, over which the retina does not pass, is the darkest internal portion of the eye in vertebrates ; and next to it, in the majority of these, are the ciliary processes of the choroid, and its anterior lateral portions.

From these premises the conclusion is deducible that in vertebrates much light is reflected from the bottom of the eye-chamber during the exercise of vision without disturbing it ; but that little is reflected again, so as to return to the bottom of the eye, in consequence partly of its absorption by the pigment of the anterior portions of the choroid, partly of its escape through the pupil.

It may seem to some that this reasoning proves too much, for why is there in man and many other animals a pigment at the bottom of the eye, if reflection from the membrane there is so free to take place? To this I reply that the pigment, which is never altogether inoperative, comes into special action when the eye is exposed to very bright light, and saves the retina from the paralyzing influence of intensely luminous rays. Vision, however, cannot be continuously exercised under such exposure, even where the light is not excessively brilliant, in consequence of the instinctive closure of the eyelids, and the abundant secretion of tears which then take place. The pigment at the bottom of the eye is thus, I apprehend, a safeguard against sudden exposure to intense light ; but during continuous vision under an illumination which does not dazzle the eye, its action is secondary as an absorber of light, and it always acts as a reflector.

Hitherto I have been arguing almost solely for the negative conclusion, that the vertebrate, and especially the human eye, is not the kind of darkened chamber which it has been supposed to be. It is impossible, however, to regard the deep intra-ocular reflection which so certainly occurs in most animals, as an incidental or useless phenomenon. That it has a direct and beneficial influence over vision I cannot doubt, and I proceed briefly to indicate where the proof of this is to be found.

Intra-ocular reflection, as a normal phenomenon, is at a maximum in the tapetal or mirrored eye of the lower animals. It is desirable, accordingly, to study it first as occurring in them ; nor can a better example of a mirrored eye be found than that presented by the shark. In it the *tapetum lucidum* occupies the whole of the bottom, and one-half or more of the lateral surface of the choroid, which is covered by pigment only in front. The iris, as in other fishes, is incontractile, so that the diameter of the pupil never varies ; and the tapetum, which is colourless and very brilliant, is thus always in action as a reflector. The shark, however, swims near the surface of the sea, where the amount of light is considerable, and the acuteness of its vision is proverbial. I have selected it, rather than a mammal, with eyelids and a contractile iris, because in the shark luminous reflection never ceases unless in absolute darkness ; and when light is shining occurs the more, the brighter the light is. Its eye is thus always in the condition in which that of a cat, or dog, or ox is, when subdued light causes the iris to expand, and allows the reflecting tapetum to come into play, so that the considerations which I have to urge apply to the mammal as much as to the fish, provided they are taken with pupils equally dilated; but as the tapetum in the shark is very large, very brilliant, and always in action, I shall restrict myself for the present to it.

The light, which penetrates to the bottom of a shark's eye, will, in part, be reflected from the retina (a phenomenon which for the present I disregard), in part traverse it, and reach the tapetum, where a portion will be lost by absorption and irregular reflection or dispersion, and (what alone concerns us here) in part undergo direct reflection, return through the retina, and escape by the pupil. This returned light will impress the retina in traversing it, and illuminate external objects on leaving the eye.

The first question, then, is, "How will this light impress the retina?" According to J. Müller and W. Mackenzie, as we have already seen, only injuriously, so far as freedom from the sensation of dazzling, or distinctness of visual perception, are concerned; according to Todd and Bowman "probably" by "increasing the visual power, particularly when the quantity of light admitted into the eye is small." I have urged elsewhere that "what is equivalent to two rays of light falling upon the retina will produce two impressions. We send a capillary sunbeam through the retina in one direction, and instantly return it through that membrane, a little diminished in intensity, in the opposite direction; if it determined a sensation in its first passage, what is there to prevent its doing so in its second? If, for simplicity's sake, we suppose exactly the same points of the retina to be traversed by the incident and the reflected ray, then (unless the luminous intensity of the incident ray was so great as by its passage to exhaust the sensibility of the retina), the reflected ray will repeat somewhat less powerfully the impression made by the incident one. The difference will be as great as there is between a sound and its echo, but not greater.

On this view of matters, the tapetum, especially in twilight, will serve the important purpose of making every perceived ray of light *tell twice* upon the retina, so that the sensation it produces will either be increased in distinctness or in duration, and probably in both.

I will not deny that we are not entitled at once to infer that because a molecular change (modulation, vibration, polarization?) transmitted through a special structure in *one* direction produces a peculiar sensation, it will certainly produce the same sensation on being transmitted through that structure in the *opposite* direction ; but there are strong analogies in favour of such a view, and it is entitled to be regarded as a likely hypothesis

The first probable use of the tapetum, then, is to double the impression which light produces upon the retina, whilst that light is within the eye.

The greater part of this light, however, after traversing the retina with little diminution by absorption, passes outwards through the pupil, and, along with the light reflected from the retina, is thrown upon external objects, and illuminates them. A singular reluctance has been shown by physiologists, especially in recent times, to acknowledge this. The supposed necessity of maintaining the chamber of the eye dark, the apparent impossibility of the eye reflecting and receiving light simultaneously, and the faintness of the light emitted from tapetal eyes, have led most writers to contemn the doctrine that the tapetum is a serviceable reflector of light. But the objections to this doctrine are in reality of no value, and were not entertained by the older writers, such as Hunter and Monro, who not only regarded the tapetum as casting light on external objects, but, in the case of graminivorous animals, as affording them, by the green colour of the light which is reflected, an assistance in discovering their food; an opinion which Cuvier in part countenances.

As I have discussed this question at length elsewhere, I shall merely observe here that as the light emitted from a cat's or a shark's eye, *ex. gr.*, is veritable light, there is no room for affirming that its illuminating powers are not, *cœteris paribus*, equal to light of the same quality from any other source. If we can see a cat in the apparent darkness, which otherwise would render it invisible, by the light which issues from its eyes, it cannot be questioned that it will see us by so much of that light as our persons reflect back into those eyes. The *tapetum lucidum* is, for every creature which possesses it, a lantern, by which it can guide itself in the dimmest twilight, and make each ray of light do double or triple service, in assisting it to steer its course, and to find its food or prey.

But if the tapetum assists carnivorous animals in finding their living prey, it must also give the latter warning of the approach of the destroyer. I am not aware that this use of the tapetum has hitherto attracted attention. But a lion or a shark does not more certainly bring into view, by means of tapetal light, the creature it would devour, than it betrays its own presence to that creature, and the balance is thus mercifully maintained between the preyer and the prey. That singular "hypnotising" or "mesmerising" power which, in the case of the serpent, is called "fascination," is probably largely possessed by the glaring tapetal eye, which acts with all the advantage of surrounding darkness to increase its impressiveness, and prevent other objects from distracting the attention of the subject of fascination. On the other hand, however, the tapetal light is peculiarly startling to an observer, for it is always coloured and unlike that of day, resembling in character (in the case at least of the cat and the dog) those fluorescent rays of the spectrum, which Mr. Stokes describes as "ghostly," and of which it probably largely consists. At all events, its unfamiliar appearance specially qualifies it to alarm creatures who suddenly perceive it, and are led by instinct to flee from all strange lights.

In the lower animals, then, the tapetum is probable serviceable—

1°. By doubling within the eye the impression of each ray upon the retina.

2°. By reflecting light from the eye upon external objects, so as to render food or prey more visible.

3°. By warning, through the agency of that light, creatures on which carnivorous animals prey, of the neighbourhood of their enemies.

In the discharge of those functions the retina more or less conspires, differing from the tapetum chiefly in reflecting a less coloured light than the latter does. Further, in such of the lower animals as have not tapeta, there must occur in most, alike from the choroid and the retina, and in all at least from the retina, reflection of light. In those whose eyes exhibit choroidal reflection, the same good ends will be served by it, though in a much less degree, as are secured by tapetal reflection, and of these probably the most important is the first, which cannot be attained with light reflected from the retina.

How far human wisdom is *sensibly* influenced by the choroido-retinal reflection which is continually occurring within the living eye, it is difficult to decide; but it must be influenced to some extent by it. It seems probable that the acute vision in faint light which characterizes those who are imprisoned in dark chambers, and which the astronomer sometimes purposely induces by long shading of his eyes before making observations, is in part due to the return of light from the choroid through the retina; in part to the passage through the highly-dilated pupil of light reflected both from the choroid and retina, which is thrown upon external objects. It may startle us at first to be told that we see in part by light issuing from our eyes, but it must be so; and those traditions of learned men who could read by the light of their own eyes in what was darkness to others, are only exaggerations of a power more or less exercised by every human organ of vision.

To one result of this choroido-retinal reflection in the human eye, I would, in conclusion, refer. The light which is thus reflected, is always *coloured*, being, as we have already seen, red, yellowish-red, or brownish-red, and differing necessarily in its tint, according to the abundance of pigment in different eyes. Each of us thus adds to every object on which he looks so much *colour*, but no two pairs of eyes the same amount, and hence one great reason why no two persons, almost, will be found to agree as to the matching of one colour with another where the coloured substances compared consist of different materials; and why very marked differences present themselves in the judgments of persons equally practised in observing and copying colours.

Two artists, for example, paint from nature the same flower. The pigments which they employ for this purpose, will, of course, be as much affected by the colour communicated from the eye, as the flower is, so that, could the latter be imitated in its own materials, the copies might be identical. But as these must be made with substances whose lustre, transparency, and particular tint, differ from those of the body copied, the added colour from the eye tells unequally on the original and the copy, as compared together, and as seen by different eyes. Each, accordingly, objects to the other's colouring, but neither can induce his neighbour to adopt his tints, and both appeal confidently to third parties (who perhaps differ from both), assured that the adjudication will be in favour of the appellant. Here each may have been equally skilful and equally faithful: and neither has any means of testing to what extent he sees everything as if through coloured spectacles, which give all objects a tint for him inseparable from their natural colour. A "chromatic equation," thus originated, belongs, I believe, to every eye.

P.S.—From my friend Professor Goodsir, who recently (June 27th) delivered a lecture of great interest and originality on the retina to the anatomical students of the University of Edinburgh, I learn that, from the observations and speculations of the Continental Physiologists, it appears very probable that *only* the rays of light which are returned from behind through the retina produce a luminous sensation, and that the objective perception of light commences physically at the choroidal, not the hyaloid extremity of the optically sensific constituents of the retina. According to Kölliker, this objective perception begins at the extremities of the rods and bulbs which are in contact with the pigment of the choroid,—a view of matters not readily reconcilable with the organization of the *yellow spot*, where vision is most perfect; according to Brücke, luminous sensation begins in a layer of gray nervous substance, situated nearer the front of the retina; but both observers agree in ascribing entirely to that light, which is passing back from the choroid, the power of initiating luminous perceptions. I have argued, in the preceding paper, for such returned light being *accessory* to vision, but according to this view it is the only light by which it is exercised. If this doctrine (however modified in details) be established, the reflection of light from the choroid will prove to be *essential* to the function of seeing, and the necessity for the living eye being a Camera Lucida, will be based upon deeper grounds of proof than I have attempted to offer.

The Prize Essays.

1.—Canada; An Essay—. *To which was awarded the First Prize by the Paris Exhibition Committee of Canada.* By J. Sheridan Hogan. John Lovell, Montreal.

2.—Canada and Her Resources;—*An Essay, to which was awarded the Second Prize by the Paris Exhibition Committee of Canada.* By Alexander Morris, A.M., Barrister at Law. John Lovell, Montreal.

3.—Canada: Physical, Economic, and Social. By A. Lillie, D.D. Maclear & Co., Toronto.

On the 13th November, 1854, the Executive Committee of the Paris Exhibition issued an advertisement announcing their intention of offering for public competition three prizes for the best three essays on "Canada, and its resources; its geological structure, geographical features, natural products, manufactures, commerce, social, educational, and political institutions, and general statistics." Practical utility and comprehensiveness, combined with conciseness, were to be among the chief considerations on which the awards of the judges would be based. The Essays were to be sent to the Secretary of the Executive Committee on the 15th February, 1855, thus allowing exactly ninety-two days, or three months, for the production of a work on Canada embracing a comprehensive description of the physical and social condition of the country.

No one, we suppose, who takes the trouble to consider the nature and extent of the subjects suggested by the Committee, can fail to be convinced that the time allowed was much too short. Indeed, as the period for the reception of the Essays drew to a close, the Executive Committee appear to have become convinced of the necessity of extending the time as much as lay in their power, and accordingly they added fifteen days to the three months before granted.

The opportunities thus afforded for obtaining literary distinction were, however, sufficiently enticing to bring into the field no less than nineteen competitors for the honours and emolument offered by Government. Of the essays subjected to the consideration of the judges, three were reported "prizeworthy," three received honorable mention, one was passed over as illegibly written, and twelve remain in the hands of the Assistant Secretary of the Committee, from whom they may be obtained by the authors. The judges being unable to decide upon the order in which the three essays reported prizeworthy should stand, requested his Excellency the Governor General to make the award. No more capable or disinterested judge could have been selected, or one from whose expressed opinion disappointed competitors or their friends would feel inclined to appeal; and after a careful perusal of the two competing essays which are named at the commencement of this article, we do not hesitate to avow our conviction of the justice of that award. We do not wish it to be understood, however, that *any* one of the essays before us presents a complete picture of Canada; it is not to be supposed that the short period of fourteen weeks would embrace time enough for any writer, however familiar with its physical history and its social condition, to describe the country, its resources and its people with minuteness and detail. The evident object of the Executive Committee of the Paris Exhibition was to obtain a readable account and description of Canada and its institutions, in order to place in the hands of the middle classes in Europe a popular exposition of what we offer here to industry and enterprise. Mr. Hogan has furnished us with such an essay, which, though certainly not free from sins of omission and a sprinkling of errors, is capable of creating a very interesting, encouraging and truthful impression of many leading features in Canadian life, and of the encouraging future which lies within the reach of every immigrant, and is the sure destiny of the country at large. In the introductory chapter to Mr. Hogan's essay, we find especial allusion made to the class of people for whose information and guidance the essay was, with judicious care, more particularly written. After alluding to the significant facts, that the population of Western Canada in 1829 was only 190,000, and the value of the real and personal estate of the people estimated at £25,000,000, that, in 1854 the number of its inhabitants had swollen to 1,237,600, and its assessed and assessable property to £50,000,000, Mr. Hogan asks:—

"And who and what are the people who divide among them this magnificent property? And how have they acquired it? Did they come in as conquerors, and appropriate to themselves the wealth of others?—They came in but to subdue a wilderness, and have reversed the laws of conquest; for plenty, good neighbourhood, and civilization mark their footsteps. Or did capitalists accompany them, to reproduce their wealth by applying it to the enterprises and improvements of a new country? No;—for capitalists wait till their pioneer, industry, first makes his report, and it is but now that they are studying the interesting one from Canada. Or did the generosity of European Princes, or European wealth or benevolence provide them with such outfits as secured their success? On the contrary, the wrongs of Princes, and the poverty of Nations, have been the chief causes of the settlement of America. Her prosperity is the offspring of European hopelessness. Her high position in the world is the result of the sublime efforts of despair. And he who would learn who they are who divide among them the splendid property created in Canada has but to go to the quays of Liverpool, of Dublin, of Glasgow, and of Hamburg, and see emigrants there embarking, who knew neither progress nor hopes where they were born, to satisfy himself to the fullest."

The description of the geographical features of the country is very general, and in some instances unnecessarily so, for we find no reference made, even in name, to the rivers, Thames and Grand River, which unwater the richest and most fertile portion of the Western Province. The chapter devoted to the "Geological features and soil" of the country is occasionally obscure, and not without mistakes, which, with a little reflection and care, might have been avoided. "All the great lakes are placed in the line of contact between two vast chains of Granite and Limestone." How does this general statement apply to Lake Ontario and Lake Erie, the lakes *par excellence* of Canada. The Granite is met with at the eastern extremity of Lake Ontario, and the lake itself is excavated wholly out of unaltered Lower and Upper Silurian rocks. Lake Erie is excavated entirely out of Upper Silurian and Devonian rocks, and in no part is less than 200 miles from granite exposures. The observation is partially correct with regard to Lakes Huron and Superior, the least important of Canadian lakes. Again, "From Quebec to Niagara the red slate [?] is perhaps the prevailing rock," and in the very next line, "the subsoil around Lake Ontario is limestone on granite." . . . . "On Lake Erie the strata are limestone, slate [?] and sandstone." These contradictions and errors acquire importance in Canada where the real facts are locally known, because they leave room for cavil and ungenerous criticism, and may affect the value of the essay and the interests it is well designed to subserve.

The chapter describing the struggles and hopes of the early settler of Upper Canada is a truthful picture; the one which follows it, portraying the farmer of Upper Canada as distinguished from the early settler, is also well drawn and very encouraging:—

"Were I asked what is the leading characteristic of the Upper Canadian farmer, I should unquestionably answer, Plenty. Plenty

reigns in his granary, plenty is exhibited in his farm yard, plenty gleams from his corn fields, and plenty smiles in the faces of his children. But let it not be imagined that this plenty is gained without continuous labour, and the exerciso of judgment and intelligence. Many of the finest farms in Upper Canada have passed out of the hands of those whose fathers won them from the forest; and many more are exhausted and unproductive, through injudicious management, indolence, or inattention; and in some instances the very labourers on the farms which have been sold and wasted by the second generation, have been able to purchase them. Industry literally converted the labourer into the lord, whilst extravagance and indolence reduced the lord to the labourer."

Canada contains a population at the present moment exceeding two and a quarter millions, and, as Mr. Hogan justly remarks :—

"There is perhaps no part of the world known to modern history, with the exception of California and Australia, where a greater increase has taken place in the population. In the latter countries the discovery of gold has imparted an unnatural stimulant to settlement; but in these places, unfortunately, the chief things which labour leaves to mark its footsteps are unsightly cuttings and mounds,—the monuments too often of hardships without rewards, and bitterly disappointed hopes. But in Canada labour is marked by corn fields, which contribute to the riches and comforts of the whole world; and success is of that character, that it raises man by its example, and makes whole races respectable."

The chapters on manufactures and ship-building; trade and commerce; revenue and expenditure; banks; inducements to emigrants; wages; and price of land, are sufficiently amplified to afford a general idea of a rapidly growing commerce, and a condition of progress and prosperity which is only paralleled by the States of the Union in the region of the Great Lakes. It is a favourable feature in the financial condition of Canada, that the bugbear taxation presses so lightly upon the farmer. Perhaps no country in the world is more free from this incubus than Canada with reference to the country at large, and it is a matter of individual regret to every one interested, that the same remark does not apply to our cities and towns, many of which are beginning to acquire an unenviable notoriety for the rapid increase of this objectionable burden :

"From a table recently compiled in England it appears that the sum contributed by the inhabitants of Canada to the revenue is considerably less than that contributed by any other British Colony. The inhabitants of the Australian Colonies contribute two pounds per head, the West India Islands one pound, and the other British North American Provinces ten shillings. Canada contributes eight shillings and two pence. The revenue for 1854 is estimated at £1,423,520, and the expenditure at £939,595, or at the rate of 8s. 2d. for each inhabitant. The Boston Almanac gives the expenditure of the United States at £12,939,876, which, divided into the population, makes 11s. 1d. per individual, or thirty-seven per cent. higher than the indirect taxes of Canada; but this includes 3,204,067 slaves, or nearly one-seventh of the whole population, who are not taxed; deducting these it would add fifteen per cent. per individual to the tax on the free inhabitants of the States."

A long and interesting chapter is devoted to the subject of "Internal Communication," it has evidently been hastily written, and requires a few corrections and additions, which may generally be effected by the introduction of a letter or a word, as in the following extract :—

"Tho remaining link of canal—for I may as well speak of it in this connection—between tho Gulf of St. Lawrence and tho head of Lake Superior, is the Welland, which unites Lakes Erie and Ontario, and avoids tho Falls of Niagara. Its locks are little less capacious than those on tho St. Lawrence Canals, but are equally well built. They havo chambers a hundred and fifty feet long, by twenty-six and a-half feet wide, and the available depth of water in both is between nine and ten feet."

The Sault St. Marie Canal, which unites Lakes Huron and Superior has been overlooked,—its locks have chambers 350 feet long and 70 feet in width.

Mr. Hogan's views of the importance of the River St. Lawrence, and of the magnitude of that commerce of which it is destined to become the uninterrupted highway, are fully and eloquently expressed. The following extract will show that he entertains decided views respecting the future of our noble river :—

"The first thing that strikes one, in contemplating it, is its adaptation, in point of immensity, to the vast regions it waters. Whilst the business necessities of the West, and those portions of America which are universally admitted to be, both by their relative position to other rivers and to it, its natural feeders, have literally shamed the enterprises that were intended to provide for them, its magnitude and its value are being but discovered by the contrast. The Erie Canal, highly valuable as a work, and successful beyond comparison, *has been made little by progress.* The St. Lawrence, on the contrary, only requires enormous use to test its greatness. It is impossible, indeed, to contemplate this river, in connection with the canal which was made to rival it, without being struck with the inadequacy of the one and the amplitude of the other.

"The valleys and plains watered by the St. Lawrence, being largely in the United States, have chiefly contributed to the Erie Canal's business. Their fruits were literally wooed away from their natural channel to minister to its prosperity. The St. Lawrence, in so far as American policy, and great restrictions upon commerce, could affect it, has been sacrificed to the Erie Canal. Nature's outlet had navigation laws, which drove commerce away from it, to contend against. The Erie Canal had all these disadvantages to the river converted into so many advantages in its favor. Yet the laws of progress, which have swept away the obnoxious navigation restrictions, have, at the same time, established the failure of the Erie Canal. Not that it is unprosperous as an enterprise, nor that, as a *local work*, it is not unsurpassed as a speculation, but that, for the great purposes of its construction, namely, to convey to the ocean the fruits and productions of the West and North-west, it is emphatically a failure,—*because progress has completely over-burthened it; it is literally surfeited by its own prosperity.* And it matters not to him,—an individual, in such a case, being the nation,—who has boards or flour to send eastward by it, whether they are stopped by reason of starvation, or because of a surfeit. The impediment to his business is the all-important question with him. And though the Erie Canal paid larger profits than any other work in the world, yet, in a national point of view, if it afforded not adequate facilities for business, or stopped it in its course, it might, by drawing to it what it could not do, be the means of wide-spread evil, instead of general good. And that this is, to a great extent, the present position of the Erie Canal, is universally admitted.

"To obviate these difficulties, enterprise has again undertaken to swell its dimensions to meet the enormous demands of *progress.* But in view of the vast regions which are common alike to it and the St. Lawrence, and which are as yet but in the infancy of their population and business, is it not probable; nay, is it not certain, judging by the past, that twenty years hence will find the Erie Canal again choked up with business; again *made little by progress?* When the magnificent tracts of country embraced in Michigan, Wisconsin, the northern portions of Ohio and Indiana, Illinois, Iowa, Minnesota, and the west and north-western portions of the State of New York, which now wholly or largely use the Erie Canal as a highway to the ocean, come to be settled up, and to have, instead of some five or six millions of inhabitants, at least eighteen or twenty, what *mere canal*, with its hundred locks, and its hundred other impediments, will be equal to their vast business necessities? will be in keeping with their splendid progress? will satisfy their craving for rapidity, magnitude, and commercial convenience? Will not the Erie Canal *then*, enlarged though it be, be but another added to the numerous examples in America, *of progress utterly distancing enterprise, and prosperity shaming the calculations even of talent?*"

The remaining chapters are devoted to the enterprise of Canada in relation to Railroads; their value and importance; their intent, construction, and routes. The Municipal System of Upper Canada; the Government of Canada and its future. We shall conclude our notice of Mr. Hogan's excellent essay with a few of its closing paragraphs—and the expression of a hope that an opportunity will soon be offered of avoiding, in a

second edition, those inaccuracies and omissions, which are clearly traceable to the hurry in which the essay was prepared:

"The people, I may say, of all North America—I mean the descendants of the British race, and emigrants from Britain—are, perhaps, of all others the best trained to understand and to enjoy the benefits of representative institutions. Their habits of self-reliance and the necessity for combination to effect the simple purposes of existence—to build the log hut far in the woods; to "log" the first acres of ground cleared; to throw a bridge over a stream, or to clear a road into the forest,—naturally lead them to respect skill, and to put themselves under the guidance of talent. The leading spirit of a "*logging bee*," and the genius who presides over the construction of a barn, what more natural than that they should be elected, at the annual meeting of the neighbourhood, to oversee the construction of bridges, and to judge of, and inspect, the proper height of fences? And this is the first legislation such a people have to do. The useful individual, too, in a settlement, who draws deeds and wills, and settles disputes without law, and gives good advice without cost, what more natural, also, than that he should be selected by the people he benefits by his education and his kindness, to make their laws, and to guard their interests? The Canadian people, too, have no tenant rights, nor "trades unions" to secure higher wages, or to prevent too many hours work. Their necessities are their orators. Their ways and means of living, and taking the best care of what their labour brings them, are the principles by which they are governed. Their democracy begins at the right end; for, instead of weaving theories to control the property of others, they think of but the best means of taking care of their own. Need it be wondered at, then, that a people so educated—and such has been the universal education of North America—should know how to govern themselves; should gradually rise from the consideration of the affairs of a neighbourhood to those of a county and of a country; that they should have sufficient conservatism to guard the fruits of their industry, and sufficient democracy to insist upon the right to do so. And such is a true picture of the Canadian people. Their municipal system is but a small remove from the leader of the "*logging bee*" being elected builder of the bridge, and their parliament is but a higher class in the same school of practical self-government. Their being given in fact the entire control of their own affairs was but removing expert seamen into a larger ship; and Great Britain has but to consider, in dealing with her other colonies, that the ship is always adapted to the sailors. For, the understanding a people is of infinitely greater importance, in giving them a constitution, than the understanding ever so well abstract principles of government."

We now proceed to examine the essay by Mr. Alexander Morris, A.M., to which was awarded the second prize. Mr, Morris in his preface "disclaims all pretension to originality," and tells us that "his labour has been the plodding one of a compiler." This essay is about one-fourth longer than Mr. Hogan's, and embraces copious extracts from the admirable reports of Messrs. Logan and Murray; the first chapter, referring to the geological structure of Canada, being condensed from the Report of Progress for the year 1843. The descriptions of the geographical features of the Ottawa Region and of the Eastern Townships, are very full and complete, and in general, the geography of Canada is given with considerable minuteness of detail.

Mr. Morris has, however, succeeded in disarming criticism, by limiting himself strictly to the duties of a compiler, without entering into any speculations or descriptions, which give a charm to Mr. Hogan's essay, and contribute so much to make it a readable book. Indeed the second prize essay may be described as a condensed series of miniature Blue Books, in which the chief facts relating to the products of the forest, the mines and fisheries, agricultural produce, manufactures, and commerce, are given with considerable precision and in the plainest language. The chapters on social institutions, educational institutions, political institutions, and statistics, while containing a very large amount of information, are evidently written by a gentleman whose form of thought and style of expression have been influenced by the study of a rigid profession, which of all others is least susceptible of adding a charm to the description of social progress, or interest to the dry enumeration of political and commercial triumphs. Mr. Morris's professional position enables him to write with advantage on the political affairs of Canada:—

"The Government of the Province is conducted by a Governor General, appointed by the Crown, who presides at the deliberations of an Executive Council nominated by the Crown, but who must, according to the theory of Responsible Government, in practical force in Canada, possess the confidence of the people, as evinced by a majority of the House of Assembly; and who, consequently, may lose their places on a vote of want of confidence. The Executive Council is composed of the following officials, viz.: a President of the Committees of the Council (who is also Chairman of the Bureau of Agriculture, and of the Board of Registration and Statistics;) a Provincial Secretary, an Inspector General, a Commissioner of Crown Lands, a Receiver General, one Attorney and one Solicitor General, one of each for each section of the Province; a Commissioner of the Board of Public Works, and a Postmaster General. These incumbents preside over the public departments indicated by their titles, in addition to exercising the functions of Executive Councillors. On the acceptance of office, the incumbent elect, unless a Legislative Councillor, must present himself to the people for re-election. The Solicitors General are not necessarily Members of the Cabinet.

"Such is the system of governing by Legislative majorities and responsibility to the electors, which is in force in Canada. Practically the Government of the Province is self-government, the British Government rarely interposing the weight of its authority, but, on the contrary, distinctly enunciating its desire to allow the Province the widest latitude in self-government, compatible with the Colonial relation. In fact, the Canadas enjoy the largest measure of political liberty possessed by any country or people. The public offices, and the seats in the Legislature, are practically open to all. The people, by their representatives in Parliament, regulate all matters of Provincial interest, and by their municipal system they regulate their municipal matters, while they possess and exercise the power of rejecting at the polls those who have forfeited their confidence. The inhabitants of Canada are bound to Britain by the ties of common interest, common origin, and filial attachment. Owing a grateful allegiance to their Sovereign, they are proud to share the heritage of Britain's ancestral glories, while they are not slow in evincing their sympathy with her struggles, as the magnificent grant of £20,000 sterling, gracefully appropriated by the Legislature to the Patriotic Fund, and to the widows and orphans of the soldiers of her ally, France, proudly shews. The policy of Britain is a wise one. She is building up, on the broad foundations of a sound political liberty, freedom of thought and conscience, a colony which will one day, (though the connection will never be rudely severed,) attain the position of a nation, and peopled by inhabitants knit to Britain by the strongest ties of blood, and identity of feeling, will strengthen her hands and support her position by the reflex influence of sound, national and constitutional sentiment.

"The future of Canada is a brilliant one: a great problem is being wrought out in her history; and, on review of her immense resources, and on a glance at her hardy, self-reliant population, the mind is irresistably urged to the conclusion that her destiny is a grand one, and that, on this American continent, she may yet be destined to play no insignificant part among the role of people."

Dr. Lillie's essay, entitled "Canada—Physical, Economic and Social," was passed by unread, "on the alleged ground of the illegibleness of the manuscript;" the author has therefore assumed the responsibility of its publication, partly on account of the fact of his having written being generally known, and partly in the hope of diffusing information respecting Canada. Dr. Lillie's essay is more than double the size of Mr. Hogan's, and considerably exceeds that of Mr. Morris,—it contains nearly 294 pages of printed matter, together with two excellent Maps, one of Upper Canada and the other of Lower Canada. The essay is divided into three parts, as its title implies. One hundred and thirty pages are devoted to the physical description of the country, the subject of geology forming by far the most important and extensive of this division. One hundred and seven pages are devoted to the economical history of Ca-

nada, and the remaining portion of the work, embracing fifty-five pages, is occupied with a narration of the social position of the inhabitants of the country. The absence of a good, copious index is much to be regretted. Dr. Lillie has shown an extraordinary degree of industry in preparing this essay for competition ; and the number and diversified character of the authors he quotes, testify to the large amount of literary labour he has bestowed upon the comprehensive subjects of which he treats. Here again we have to regret the shortness of the time which was allowed to competitors. We do not hesitate to say, that several startling discrepancies which occur in the first part of Dr. Lillie's work would have been avoided, if the subject had been leisurely, instead of hastily, treated. It is also extremely probable that if more time had been allowed, the author would have seen cogent reasons for rejecting certain authorities he has advanced, and for bringing into more harmonious form the disjointed descriptions of the geological structure of the Province, which, in their present shape, will we fear, sadly puzzle even an "intelligent stranger." Take for example the statement on page 12 and compare it with the actual condition of things. "In New York and Canada it (the third division of the Lower Silurian) bears the name of Utica Slate and Hudson River Group. * * * Graptolites with fragments of Trilobites are the only fossils found in this division." The Hudson River Group, which extends from the Rouge to the Credit, and at very small depth immediately underlies the City of Toronto, is eminently fossiliferous, containing besides Graptolites and Trilobites, Corals, Fucoids and numerous genera and species of shells in vast abundance. On referring to Marcou's work we found that he had evidently misled our author, for Marcou says: "Fossils are rare in this division, the only ones are Graptolites, sometimes in great abundance, and fragments of Trilobites, especially the *Trinucleus Caractaci*." An hour's inspection of the quarry opposite the parliament buildings, or of the rocks in the Humber river valley would have satisfied Dr Lillie of the value of M. Marcou as an authority. On page 13 we find the following: "Beds of Rock Salt are often found in America, in connection with the Upper Silurian." It is possible that the occurrence of salt springs may have given rise to this supposition, but we are not aware that any proof of so remarkable a phenomenon has ever been obtained in America. M. Marcou appears to be the authority in this instance also.

We are thus induced to direct attention to these discrepances as Dr. Lillie's has not only drawn largely from M. Marcou's work, but also made very copious extracts from the reports of Messrs. Logan and Murray, and adopted a style of descriptive narrative in scientific language, which removes the subject beyond the reach of the class of general readers. At pages 12 and 13 our author adopts M. Marcou's distribution of the rocks in Western Canada, simply styling them Lower Silurian, Upper Silurian, and Devonian, and from pages 58 to 64 he goes over the same ground, following Mr. Murray's classification, using the terms applied to the subordinate members of the rocks before named, without stating how widely Mr. Murray and M. Marcou differ in their classification, or in their enumeration of the fossil remains distinguishing them. This is to be regretted, and we venture to say that the object would have been better attained if Dr. Lillie had expressed in his own language a general view of the geological structure of the country, based upon the reports of the Canadian survey. We question whether Dr. Lillie is aware that of Marcou's classification of the mountain system in America—from which he has drawn to the extent of nearly four pages of his work—it has been said by a truly eminent geologist, "if we needed a parody on Elie DeBeaumont and his systéms of mountains, we have it here."

The chapter on the soils of Canada East and West, consists chiefly of extracts from the report of Mr. Hunt. On the climate of Canada chiefly of abridgments of articles contained in this Journal, and the same may be said of the enumeration of the natural productions of the country.

The second portion of the essay before us consists of extracts from a great variety of sources and authorities. Numerous passages from Dr. Lillie's own pen cause us however to regret that he had not adhered more closely throughout to an original form of expression, rather than content himself with transcribing the precise words of his authority. Here is a graphic picture, far more interesting, impressive and useful to the general reader than half a dozen extracts from "authorities :"

"Canada is constantly outgrowing the descriptions which are being given of her. The picture which was correct a few years ago thus misleads, if, instead of being regarded as exhibiting what *was*, it is viewed as illustrative of what *is*. And so it will continue to be. Without the gift of prophecy, the production now of a work which shall be true to the facts of even half a dozen years hence is an impossibility. It is only by frequent revisal, bringing them up every few years to the state of things which has grown up since their first appearance, that the very best works can be made to possess a permanent value as sources of information. Thus it is that the works of Mr. Macgregor and Montgomery Martin make the approximation which they do to the present actual state of the country.

"By way of example, we shall present a few statements from the works of Talbot, who published in 1824; and of Buckingham, whose travels in America appeared so late as 1843.

"Toronto, our inquirer will learn from the same authority, (Talbot who published in 1824) should he consult him, contains 1335 inhabitants, with about 250 houses, many of which exhibit a very neat appearance. Its public buildings are a Protestant Episcopal Church, which is a plain timber building of tolerable size, with a steeple of the same material; a Roman Catholic chapel, not yet completed, which is of brick, and intended to be very magnificent; a Presbyterian and a Methodist meeting house; the Hospital, which he pronounces the most extensive public building in the Province, describing it, at the same time, as showing a very respectable external appearance; the Parliament House, and the residence of the Lieutenant General. As for its streets, which are regularly laid out, intersecting each other at right angles, but being in wet weather unhappily, if possible, muddier and dirtier than those of Kingston—only one of them is as yet finished.

"Lay down Talbot, and take up Buckingham's "Canada, Nova Scotia, and New Brunswick,"—bearing date London, 1843—and you will learn (p. 101) that the city of which you have been reading has advanced so far as to have 13,000 inhabitants, with over 200 brick buildings, and nine newspapers, chiefly weekly, some twice, and some thrice, but none daily. So soon as you have got over your surprise at this prodigious growth, look into Tremenheere, if you can lay your hand upon it, and he will tell you, on the authority of the last census, that the population of Toronto amounted, in 1851, or rather beginning of 1852, to 30,763. At last you feel that you have got at the truth; the truth you have got certainly as to January or February, 1852; but this is January 1855. The population now, according to information received by me at the Chamberlain's office, is somewhere in the neighbourhood of 45,000. In 1851, the estimated value of property, real and personal, was £2,116,400; the assessed value (calculated at six per cent. on the estimated) £186,983 5s. Last year the assessed value amounted to £226,500 real, with £64,450 personal—in all, £290,950; and the estimated to £3,775,000 real, with £1,110,000 personal—making together, £4,885,000."

The third part of this essay is devoted to the social condition of the people of Canada, and like the preceding divisions, contains an immense amount of information, chiefly in the form of quotations. In taking leave of Dr. Lillie's essay we confess to two regrets, one being that a work containing so much valuable information, and giving evidence of considerable industry and application in its production should, by any alleged defect in the manuscript, have been passed unnoticed by the judges;

the other—before expressed—that Dr. Lillie should have "lessened the attraction of his production by taking away from it the air of originality which it might with much less labour than has been bestowed upon it have been made to wear," by a too rigid adherence to quotations from different authorities, while their views and facts might, in many instances, have been presented quite as truthfully, and far more impressively, in a simple narrative form, similar to the original paragraphs which are interspersed throughout the work.

Vermes in Grasshoppers.

Early in September last I visited a brother Entomologist, who resides in Montreal, and my stay having been limited to one week I resolved to make good use of my time; therefore, the forenoons were devoted to collecting insects, and on a few occasions in the evenings, I accompanied my friend in his boat to the Rapids opposite the city, where we fished. The bait generally used for still-fishing are grasshoppers, freshly collected and kept in a bottle. On one occasion I selected a specimen measuring about 14 lines (probably an *Œdipoda*), found commonly on the island of St. Hellens. It had been a short time in the water, and I had indication of a "nibble;" shortly afterwards, on examing the bait, the posterior part of its body had been bitten off, and something protruded, having a resemblance to white thread, and which, at first sight, I took to be its intestines. I disengaged the thread-like substance, and discovered it to be an *intestina* measuring at least *nineteen* inches in length.

From one grasshopper two vermes were taken, and three from another; the latter were longitudinally coiled, and occupied the whole of the insect's body.

One of the oarsmen informed me that the grasshoppers which he kept in the bottle, since our previous evening's fishing, were dead on the following morning, and that a large quantity of vermes lay at the bottom—evidence enough to exhibit a common disease in this speeics of Orthoptera.

Judging from its form and length, I take it to be a species of *Echinorhynchus*—a type chiefly infesting the higher orders of animals, and am led to think, have not been hitherto found in insects. They are cylindrical, without joints, with a sharp-pointed retractile proboscis.

Should students of Helminthology, or Microscopists wish to examine them, they can be seen at the Museum of the Canadian Institute.

Toronto, October, 1855. WM. COUPER.

Parasites in the Bat.

Detroit, 15th Sept., 1855.

In dissecting a small bat, a few days ago, my attention was directed to some round spots of inconceivable minuteness in that portion of the *mesentery* which connects the spleen, stomach, and small intestine. On examining the spots with the microscope, they proved to be *Cistoid entozoa*, of a species that I have not seen before, nor do I believe they have yet been described. Seen with low power, they appeared to be identical with *Trichina spiralis*, found occasionally (and only found) in human muscle, wanting, however, the remarkable external cyst, supposed to result from the irritation of the cyst containing the entozoon; but, with increased magnifying power, it is altogether a different animal, simply agreeing with the former in the spiral form it assumes in the cyst.

The body is composed of a great number of delicate segments, while its interior displays a well-developed alimentary canal, possessing a distinctly marked pyloric constriction: moreover, the stomach is provided with a mucous membrane, and muscular coat of considerably density.

On continuing my examination, I found one similar cyst in the centre of the urinary bladder, and three at its neck.

These parasites occupied the fat lobules, and 12 of them, all that there were, occurred in a space less than one-eigth of an inch square. They now form permanent preparations for the microscope.

HENRY GOADBY, M.D.

American Association for the Advancement of Science.

The following notices of the proceedings of this scientific body, at their annual meeting held in the city of Providence, Rhode Island, August 15th, 16th, 17th and 18th, are necessarily extremely brief; but of the more important papers read at the several meetings, we shall have an opportunity of giving more complete abstracts in future numbers of the *Journal:*

PHYSICS.

Notice of Earthquake Waves. By Professor A. D. Bache.—On the 23d of December, 1854, at 9 A. M., an earthquake occurred at Simoda, on the Island of Niphon, Japan, that resulted in the wreck of the Russian frigate Diana. The harbor was first emptied of water, then came in an enormous wave which again receded. (It appeared from the Rev. Mr. Jones that the whole character of the harbor of Simoda, previously surveyed by the Powhatan, has been changed by the earthquake.) A report from the Bonin Islands is not sufficiently exact to use for our main purpose, but points to Simoda as the centre of disturbance. (Simoda, according to the Rev. Mr. Jones, is volcanic; Bonin appears not to be.) Now the Coast Survey has three self-acting tide-gauges at Astoria, on Columbia River, San Francisco and San Diego. They record the rise of the tide on a cylinder turned by a clock. The apparatus is protected more or less from the oscillations that wind-waves would cause, which only cause a trembling of the index or stylus. The gauge at Astoria was but slightly affected by the earthquake wave, owing to the bar on the river and the distance it had to ascend. At San Francisco, 4,800 miles from Simoda, the wave arrived 12 hours 16 minutes after the beginning of the earthquake. A series of seven waves, each about half an hour in duration, or 35 minutes, each series successively smaller, and separated by a quiet time of an hour from the preceding, was recorded at San Francisco. At San Diego the wave had traversed 5,200 miles in 12 hours 38 minutes, and produced likewise a series of seven waves, each nearly corresponding to those at San Francisco, but the second series stronger than the first and third. In height they were less, the highest at San Francisco being .7 of a foot, at San Diego .6. The waves at San Diego could not have come from San Francisco, as they would have arrived much later. The velocity with which a wave travels depends on the depth of the ocean. The second and third series were but repetitions of the first wave that had reached the same points, travelling through shallower water. The calculations based on these data give for the Pacific Ocean a depth of from 14,000 to 18,000 fathoms. It is remarkable how the estimates of the ocean's depth have grown less. La Place assumed it at 10 miles, Whewell at 3.5, while this estimate brings it down to about 2 miles.

Frozen Wells.—Two deep wells at Owego, Tioga county, N. Y., seem to freeze in the latter part of winter, and to remain frozen until September. In the Jurassic formation of Europe, Prof. Guyot alluded to the ice caves common in that formation. He instanced one of these caves, 3000 feet above sea level, about 60 feet deep, whose bottom was always covered with ice several feet in thickness, while stalactites of ice depended from the roof. The whole was a small glacier. The stalactites were formed by water percolating through the covering of the cave. It was also stated that there was a cleft in the mountain not far west of Williams College, called the Snowhole, where snow might always be found. Similar occurrences had also been noticed in a range of mountains, composed of a porous sand rock, in Southern Virginia.

It was remarked by Prof. Agassiz, that he had never been able to find any large accumulations of ice with a temperature much below

the freezing point. He would ask if there were any such. Prof. Henry said that during the past winter he had been struck with the fact that pieces of ice wrapped in a cloth were frozen to it, although not one out of the several thermometers would go down to 32. It appeared from this, as from the old observation of La Place, who found that the ice surrounding the worm through which they were transmitting gases was soon frozen to the worm, that melting ice produced a certain degree of cold. The temperature of a mixture of ice and alcohol, in the form of wine, brandy, &c., was lower than 32°. Hence ice and alcohol was a freezing mixture.

Professor Agassiz explained the different kinds of ice. First was that produced by the freezing of the surface of the water and successive layers of water beneath it, a laminated schistose mass. Into this bubbles from the bottom of the pond were frequently frozen, and when it was subjected to the action of the sun the bubbles became heated, melted the ice around them, and rendered it of no marketable value. It would therefore be worth while for ice gatherers to cover their ponds with cloths, or something which would prevent these bubbles from rising. Glacier ice was formed like pudding stone; compact masses being cemented together, so that when you exposed a large lump of glacier ice to the heat of the sun it would crumble in pieces. It was like the decomposition of conglomerate; we had ice sand. Icebergs could be determined to be derived from glaciers, and not to be the frozen surface of the ocean, by their conglomerate composition. Pebbles in glaciers becoming heated melted the ice beneath them, and quarried their way down to where the heat of the sun could not reach them. The pot holes formed in this way were soon covered with a thin film of ice, but it was only during the protracted cold of winter that they were frozen through.

ASTRONOMY.

Solution of the Adams Prize Problem for 1857—Part First. By Prof. Benjamin Pierce.—The problem has for its subject the Motion of Saturn's Rings, allowing them to be solid or fluid, concentric or eccentric, He reserved the consideration of solid rings of immoveable parts for a meeting of the Mathematical section, when by use of formulæ he would prove it untenable. Can it be made up of a mass of satellites moveable among themselves? Then they must be in continual motion among themselves; revolving among themselves about their common centres of gravity, perpetual collisions ere this would have reduced them to powder. We assume now that the rings are fluid. Then they may vary in form. It was first shown that they had varied by Otto Struve. The diameter of the outer part of the ring is not known to have changed. The inner edge is contracting as it seems to me. Huygens, in 1657, made it (allowing for the irradiation of his telescope) 6.5″ Huygens and Cassini, in 1695, made it 6″; Bradley, in 1719, 5.4″; Herschell, in 1799, 5″; Struve, senior, in 1826, 4.36″; Encke and Galle, in 1838, 4.04″; and Otto Struve, in 1851, 3.67″ Does it decrease uniformly? I think it is decreasing more rapidly, and the present rate will bring the ring to an end, in certain parts of it, in about 80 years from now. I will show in the meeting in section that the planet does nothing either to maintain or destroy the equilibrium of the ring. The satellites tend to maintain it in place. The ring is not gas; its density is nearly that of water. If the zodiacal light be a gaseous ring of the earth, it would need some solid parts to give body to it. May that gas be the atmosphere around an infinity of small masses revolving about each other and about the earth? May there not be collisions among these revolving masses that throw down parts of them to the earth? Is not that as good a reservoir of meteors as the moon? Their melted state seems to lead us to a lunar volcanic origin; but unless some lunar volcano pointed expressly at the earth were put in furious operation, such a bombardment could not hit the earth with one in ten thousand of its projectiles. Prof. Pierce is inclined to adopt this hypothesis. The action of Saturn would tend to bring a solid inflexible ring against itself.

Dr. Peters would conclude from the data of Prof. Pierce, that the cataclysm of the contact of the ring would occur about 1893 instead of 1935. But Struve has strangely omitted the observation of Bessel made with the heliometer, a more accurate instrument than the filar micrometer used by Struve at Dorpat, and by Encke and Galle at Berlin. By using these data the time would be reduced so that the present generation may hope to see it.

Prof. Pierce thought the data too imperfect to use in a calculation of time. It does not appear certain that it is not a vibration which will go on in due time to recede again from the planet. But of this we can as yet obtain no evidence.

On the Asteroid Planet. By Prof. S. Alexander.—By a most masterly use of circumstantial evidence of a delicate nature, Prof. Alexander has arrived at almost a certainty that in the space between Mars and Jupiter once revolved a planet a little more than 2.8 times as far from the Sun as our earth. The equatorial diameter was about 70,000 miles, but the polar diameter only 8 miles! It was not a globe but a wafer—nay a disc of a thickness of only 1-9,000 of its diameter. Its time of revolution was 3.698 days, say 3 days 15 hours 45 minutes. The inclination of its orbit to the ecliptic was about 4°. It met a fate that might have been anticipated from so thin a body, whirling so furiously, for its motion on its axis was 1-16th of its velocity in its orbit, say, 2,477 miles per hour. It burst as grindstones and fly-wheels sometimes do. We have found 35 fragments of it and call them asteroids. When it burst some parts were moving 2,477 miles per hour faster than the centre did, and some as much slower; that is, some parts moved 4,954 miles per hour faster than the others. These described a much larger orbit than the planet did, and the place where it burst was their perihelion. Others described a smaller orbit, because they left that point with a diminished velocity; it was, their aphelion. Some flew above the orbit of the planet and had their ascending node. Others flew below, and it was their descending node. They seemed to go almost in pairs. Two went very far out of the plane of the orbit, so that they pass the limits of the zodiac, and it is found that the ascending node of 18 correspond nearly with the descending node of 17, so nearly even were they distributed. And thin as was the planet, it had not cooled so much at the time of the explosion that none of the fragments could assume a spherical form.

The planet's place was first to be found. Three or four independent processes were used for this, and they agreed surprisingly. He interpolated it as a lost term in a geometric series, from Mars to Saturn, for the first approximation. He compared it with Saturn and Jupiter, and with Mars and Jupiter. He found where a planet would be dropped off in the successive cooling and contracting of the solar system. And he compared its orbit for size and ellipticity with those of the asteroids. Some of them gave solutions very far from the average. Rejecting these, the others coincided with previous deductions and with each other surprisingly. Its day he found by Kirkwood's analogy. Its equatorial diameter was the result of two calculations, one of which would inevitably give a result too large, and the other too small, in all cases when the planet did not explode at its equinox, when it would be exact. These numbers were 78,425 and 68,646 miles. A just comparison gave 70,470. But we can follow these calculations no further.

It is curious to see how the history of this planet verifies the theory of La Place, that a heavenly body must be either nearly a sphere or a disc, and that the latter must be unstable. And this reminded Prof. Alexander again to allude to the earth's ring—the zodiacal light. He had long been convinced that the moon could not be the only satellite thrown off by our planet in taking on its present form, but knew not where to look for the rest. A more careful calculation of the data furnished by the Rev. Mr. Jones, had given him for the diameter of the ring 17,000 miles, and a time of about half a day for rotation. And curiously enough, half a day was the time that had been assigned by a previous calculation for the revolution of an ærolite round the earth.

Solar Red Flames.—Professors Alexander and Henry were observing together upon this phenomenon. It is now settled that this red light comes from the edge of the sun, and can be seen only by the aid of peculiar colored light. But using a large Fresnel lens, and throwing the image two inches in diameter on wood, it took fire, and behold in the smoke I saw the red flames of the sun as seen seventeen years before! And strange to say, they were only visible in the glass which showed the red flame in the sun. When the eye becomes tired by gazing on bright white light, the flame of a candle is invisible through all other screens but that kind; in that it is crimson. It is probably a subjective coloring existing in the eye, and is the result of white light.

GEOLOGY.

Graptolites.—Prof. James Hall gave some notes upon the genus Graptolithus. The genus Graptolithus includes now about ten species of fossil remains, most of which are American, and of some of which Prof. Hall has recently found better specimens than ever before.

They are compound animals of the family Bryozoa, the lowest type of the class Mollusca. They consist of a kind of radiating frame apparently covered in whole or in part with a kind of web, so as to resemble the rays and cloth of a parasol. But they do not radiate from a centre, but from two ends of a line by bifurcation or trichotomy, so as to preserve a bilateral symmetry. The separate rays only have generally been observed, which have been referred to Cephalopoda or Radiata. They appeared to be tubes with one or two rows of serratures on their edges. The Professor now regards these notches as each a part of a simple animal, and that where there is but one row of serratures visible, it is because they are so folded as to hide the other.

Prof. Agassiz thought the case before us a good example of the difficulties with which the fossil zoologist has to contend. Who would ever make out the structure and use of this tool (the parasol) by finding only single sticks of one? The difficulty is greater in a compound animal, for if a man substituted the laws that hold a community together for the physiological laws that prevail in the human system, he would go widely astray. But Prof. Agassiz had met something very like the Graptolithus among the marine animals of Key West, furnished him by the Coast Survey. And here we find a further instance of the fact that ancient races, extinct in the Eastern Hemisphere, are still represented by a few species in the New World.

The Mauvaises Terres.—Professor James Hall gave some account of the Geology of Nebraska and the Mauvaises Terres. The country on the Upper Missouri River—Nebraska—he said, had been known to us for many years. Until within a few years past our knowledge had been derived from Lewis and Clark, Nicolay and some others. All these had brought specimens from Nebraska, from which we had learned that for a great distance along the Missouri river, beginning at the mouth of the Platte, and extending several hundred miles northerly, there was a cretaceous formation, the most prominent fossils of which were Ammonites and Bacculites. All had shown that this existed in a largely developed scale, but with the exception of Nicolay, no attempt was made to establish subdivisions. In 1847 we had for the first time a published notice of the existence of an extensive tertiary formation in that region, given by Dr. Prout, of St. Louis. This was, however, to the West of Missouri. Subsequently Mr. Culbertson brought collections, and Dr. Owen directed Mr. Evans to make collections, from which we had a pretty good knowledge of tertiary and its mammalia. Mr. Hall's principal object in making collections was not to make discoveries of new species, but the investigations of Dr. Owen did not tell us whether there were distinct formations or not, and moreover it seemed an important consideration that the flora corresponding to the ancient fauna should be known. That was not accomplished by the expedition, but we had some more details with regard to the tertiary and cretaceous formations. In the neighborhood of the mouth of the Platte the carboniferous formation terminated. Passing up the Missouri we found that the carboniferous passed into cretaceous. At their junction was a sandstone which might perhaps be older than the cretaceous. Upon it lay a buff calcareous rock, which would mark like chalk, containing scales and jaws of fishes. Above this was a great thickness of clays which contained most of the species that had been brought from this part of the country. A thinner bed above the clay was characterized by a large baculites. Those subdivisions extended over the western country, and we had yet to seek their characteristic fossils. The species already described already amounted to between thirty and forty, and he had about an equal number of new species. At a considerable distance west of the Missouri the cretaceous beds began to dip slightly to the west. Above the bed characterized by baculites and 80 miles west of the Missouri commenced the tertiary, at first containing no fossils, but about 80 miles further on there were palæotherium and fossil turtles within twenty feet of the cretaceous, although the tertiary nearer the river was 50 or 60 feet high. They concluded, therefore, that the beds were unconformable, the cretaceous dipping westward and the tertiary being deposited horizontally upon it, so that the eastern tertiary began to be deposited when the western was already 250 feet thick. The mauvaises terres were formed of this tertiary extensively denuded. Two new species of mammals had been discovered, one of them allied to the musk deer and the other a small carniverous animal. He was indebted to Mr. Meek and Mr. Hayden for the specimens which he exhibited. The shortest term to express the character of Nebraska was to say that it was a perfect desert, incapable of supporting men or animals except in a migratory condition. The buffaloes came in the spring with the grass, and went away in midsummer when it was gone, and the Indians followed them. There was almost no wood; some few shrubby willows, and a cotton-wood a foot in diameter was always known as the big cotton-wood, and now that it was gone the place was still called Big Cotton Wood Spring. Pure water was rarely met with. There were occasionally some springs in the baculite formation which commenced 75 miles west of the Missouri. The deep clay beneath it was almost impassable. In the spring it was all mud, and in the summer the clay cracked so as to draw out the roots of vegetation and destroy it. Along the bottoms were occasionally a little good soil, but it was not valuable. This clayey soil was dark, but not with organic matter. He had seen in Mr. Meek's notes that night after night he was compelled to camp with bitter water, and send out the men to gather a few stunted willows or cotton-wood for fire. Most of the water was impregnated with saline materials; and as all the water in the Mauvaise Terres contains sulphate of magnesia, the party was compelled to submit to its medicinal effects. Southward toward the Platte was some better land but little wood. Kansas was much like Nebraska, and the climate was such that in a great part of the territory it would be difficult for New England men to exist. He knew that Nebraska was a desert, and would remain so for all time to come. [This curse of barrenness does not apply to the settled portions of Kansas. They are carboniferous.]

On the Polishing of Granite by Driving Sand. By Mr. Wm. Blake.—A short paper on the cutting and polishing of granite by driving sand in the Colorado Pass, was read by Mr. Blake, who exhibited specimens of the grooves and channels, as well as of the polished surface of the rock. The whole surface of the granite in the pass, he said, was cut into long and beautiful grooves, which had a fine polish. Even quartz was cut away and polished by the incessant action of the sand. Garnets imbedded in feldspar stood out and protected the feldspar behind them. The little fingers of stone thus produced all pointed to a constant west wind drawing through the pass. This grooving and polishing might be seen in all parts of the desert where there were rocks to be acted upon. The polish was not like that of the lapidary, but looked more as though the rocks had been oiled or varnished. Some of the grooving and polishing which had been ascribed to glaciers, might perhaps be referred to this cause.

Prof. Agassiz said that he was particularly interested in these phenomena, since he had devoted so many years to the study of the glaciers. To know that there was another series of phenomena similar to the glacial was very interesting, and suggested caution in ascribing any apparent phenomenon to either the one or the other cause. He was pleased to see that no objection had been made to the possibility of glaciers having produced similar phenomena, and that their existence was acknowledged by Mr. Blake. It became necessary to distinguish the two sets of phenomena. Sand in order to be moved over such surfaces must be of very nearly uniform size. Now in the glacier we had two different phenomena produced simultaneously; one was the polishing of the surfaces, and the other the grooving and scratching produced by the larger masses of rock in the glacier. These features were certainly sufficient to distinguish between glacial action and the wearing of currents of sand.

Coal Fields of Missouri and Illinois.—Prof. Hall expressed an opinion that about three-fourths of the Missouri and Illinois coal fields marked out by Owen would have to be wiped off the map, and its place supplied by silurian, with its pentamerus, oblongus, and other characteristic fossils. He had seen lower silurian and upper silurian fossils over large areas of Owen's coal fields. He supposed most of that coal to be outlayers resting in basins, and having no connection with each other.

Geology in America.

An Address delivered before the American Association for the Advancement of Science, assembled at Providence, Rhode Island, August 17th, 1855, by Professor James D. Dana.

In selecting a topic for this occasion, I have not been without perplexity. Before an Association for the Advancement of Science—Science in its wide range—a discourse on the progress of science in America for the past year would seem legitimate. Yet it is a fact that original memoirs in most departments, published within that period, would make a very meagre list. Moreover, it is too much to expect

of any one to roam over others' territories, lest he ignorantly gather for you noxious weeds. I have, therefore, chosen to confine myself to a single topic—that of Geology, and I propose, instead of simply reviewing recent geological papers, to restrict myself to some of the general conclusions that flow from the researches of American Geologists, and the bearings of the facts or conclusions on geological science.

I shall touch briefly on the several topics, as it is a subject that would more easily be brought into the compass of six hours than one. In drawing conclusions among conflicting opinions, or on points where no opinion has been expressed, I shall endeavour to treat the subject and the views of others in all fairness, and shall be satisfied if those who differ from me shall acknowledge that I have honestly sought the truth.

In the first place, we should have a clear apprehension of the intent or aim of Geological Science. It has been often said that geology is a *history*, the records of which are in the rocks; and such is its highest department. But is this clearly appreciated? If so, why do we find text-books, even the highest in authority in the English language, written back-end foremost—like a history of England commencing with the reign of Victoria? In history, the phases of every age are deeply rooted in the preceding and intimately dependent on the whole past; there is a literal unfolding of events as time moves on, and this is eminently true of geology.

Geology is not simply the science of rocks; for rocks are but incidents in the earth's history, and may or may not have been the same in distant places. It has its more exalted end—even the study of the progress of life from its earliest dawn to the appearance of man; and instead of saying that fossils are of use to determine rocks, we should rather say that rocks are of use for the display of the succession of fossils. Both statements are correct, but the latter is the fundamental truth of the science.

From the progress of life geological time derives its division into Ages, as has been so beautifully exhibited by Agassiz. The successive phases in the progress of life are the great steps in the earth's history. What if in one country the rocks make a consecutive series without any marked interruption between two of these great ages, while there is a break, or convenient starting-point, in another? Does this alter the actuality of the ages? It is only like a book without chapters, in one case, and with arbitrary sections in another? Again, what if the events characteristic of an age, that is, in geology, the races of plants or animals—appear to some extent in the preceding and following ages, so that they thus blend with one another? It is but an illustration of the principle just stated, that *Time is One*—ages have their progressive developement, flowing partly out of earlier time, and casting their lights and shadows into the far future. We thus distinguish the ages by the culmination of their great characteristics, as we would mark a wave by its crest.

Divisions of time *subordinate* to the great ages will necessarily depend on revolutions in the earth's surface, marked by an abrupt transition either in the organic remains of the region, or in the succession of rocks. Such divisions are not universal. Each continent has its own periods and epochs, and the geologists of New York and other States have wisely recognized this fact—disregarding European stages or subdivisions. This is as true a principle for the cretaceous and tertiary, as for the Silurian and Devonian. The usurpation of Cromwell made an epoch in English annals—not in the French or Chinese. We should study carefully the records before admitting that any physical event in America was contemporaneous with one in Europe. The unity in geological history is in the progress of life, and in the great physical causes of change—not in the succession of rocks.

The Geological Ages, as laid down by Agassiz, are the following:—I. The *Age of Fishes*—including the Silurian and Devonian. II. The *Age of Reptiles*—embracing from the Carboniferous through the Cretaceous. III. The *Age of Mammals*, or the Tertiary and Post-Tertiary. IV. The *Age of Man*, or the recent era—*fishes* being regarded as the highest and characteristic race of the first age, *reptiles* of the second, and *mammals* of the third.

More recent researches abroad, and also the investigations of Mr. Hall in this country, have shown that the supposed fish remains of the Silurian are probably fragments of *Crustacea*, if we except those of certain beds near the top of the Silurian; and hence the Age of Fishes properly begins with the Devonian. What, then, is the Silurian? It is pre-eminently the Age of Molluscs.

Unlike the other two Invertebrate Sub-kingdoms—the Radiate and Articulate, which also appear in the earliest fossiliferous beds—the Molluscan Sub-kingdom is brought out in all its grander divisions. There is not simply the type, but the type analyzed or unfolded in its several departments from the Brachiopods and Bryozoa up to the highest group of all—the Cephalopods. And among these Cephalopods, although they may have been inferior in grade to some of later periods, there were species of gigantic size—the shell reaching the length of ten or twelve feet. The Silurian is, therefore, most appropriately styled the Molluscan Age.

The Palæozoic Tribolites were the lowest among Crustacea, and Crustacea rank low among Articulates; moreover, Crustacea (and the Articulata in general) did not reach their fullest development until the Human Era.

The Radiata were well represented in the Silurian periods, but, while inferior to the Mollusca as a Sub-kingdom, only the Corals and Crinoids —the lower fixed or vegetable species—with rare exceptions, occur in the Silurian or Molluscan Age.

Viewing the history, then, zoologically, the ages are, the Age of Molluscs—of Fishes—of Reptiles—of Mammals—of Man.

We may now change the point of view to the Vegetable Kingdom. The ages thence indicated would be three:—

I. The *Age of Algæ* or Marine Plants—corresponding to the Silurian and Devonian.

II. The *Age of Acrogens*, or Flowerless Trees—that is, the *Lepidodendra*, *Sigillariæ*, and *Calamites*—corresponding to the Coal Period and the Permian—a name first proposed by Brongniart, and which may still be retained, as it is far from certain that the Sigillariæ and Calamites are most nearly related to the *Coniferæ*.

III. The *Age of Angiosperms*, or our common trees—like the oak, elm, &c.—beginning with the Tertiary.

The interval between the second and third of these ages is occupied mainly by Coniferæ, the pine tribe, and Cycadeæ, the true Gymnosperms, species of which were abundant in the Coal period, and have continued common ever since. The Coniferæ, in the simplicity of their flowers and their naked seeds, are next akin to the Acrogens, or flowerless trees. Although in the main a flowerless vegetation—for the supposed remains of flowers observed abroad have been recently referred to undeveloped leaf buds—it appears from the observations of Dr. Newberry, that there were true flowers over the Ohio prairies, apparently monocotyledinous, and related to the lily tribe. But no palms or monocotyledinous trees have been found here.

Combining the results from the Animal and Vegetable Kingdoms, we should introduce the age of Acrogens, for the Coal period and Permian between the age of Fishes and the age of Reptiles—a space in time zoologically occupied by the overlapping of these two ages.

The order then reads: the age of Molluscs, of Fishes, of Acrogens or Coal Plants, of Reptiles, of Mammals, of Man.

The limits of these ages are as distinct as History admits of; their blendings where they join, and the incipient appearance of a type before the age it afterward characterizes fully opens, are in accordance with principles already explained.

The reality of progress from lower to higher forms is not more strongly marked in these names properly applied than in the rocks. If hereafter mammals, reptiles, or fishes are found a little lower than now known, it will be changing but a sentence in the history, not the grand idea which pervades it.

A theory lately broached by one whose recent death has caused universal grief to science, supposes that the Reptilian was an age of diminished life between the two extremes in time—the Palæozoic and Mammalian ages. But in fact, two grand divisions of animals, the Molluscan and Reptilian, at this time reach their climax and begin their decline, and this is the earliest instance of the highest culmination of a grand zoological type.

Preceding the Silurian of Molluscan Age, there is the Azoic Age, or age without animal life. It was so named by Murchison and De Verneuil, and first recognised in its full importance and formally announced in this country in the Geological Report of Messrs. Foster and Whitney, although previously admitted as a general fact by most geologists.

It embraces all the lowest rocks up to the Silurian, for much of the lowest granite cannot be excluded. The actual absence of animal life in the so-called Azoic Age in this country is rendered highly probable, as Foster and Whitney show, by the fact that many of the rocks are slates and sandstones, like fossiliferous Silurian rocks, and yet have no fossils; and, moreover, the beds on this continent were uplifted and folded, and to a great extent crystallized on a vast scale, before the first Silurian layers were deposited. A grand revolution is here indicated, apparently the closing event of the early physical history of the globe. As plants may live in w[illegible] too hot or impure for animals, and moreover since all nature exemplifies the principle that the earth's surface was occupied with life as soon as fitted, and with the highes

forms the conditions of the time allowed, we may reasonably infer that there may have been in Azoic times marine plants and plant infusoria, forms adapted to aid in the earth's physical history; and this vegetation may have long preceded animal life on the globe.

After these general remarks on the divisions of geological time, I now propose to take up the characteristic features and succession of events in American Geology.

In the outset we are struck with the comparative simplicity of the North American continent, both in form and structure. In outline it is a triangle, the simplest of mathematical figures; in surface it is only a vast plain, lying between two mountain ranges, one on either border; the Appalachian, from Labrador to Alabama on the east, the Rocky Mountains on the west; and on its contour it has water, east, west, north, south.

Observe, too, that its border heights are proportioned to the size of the oceans. A *lofty* chain borders the Pacific, a *low* one the narrow Atlantic; while the small Arctic is faced by no proper mountain range.

This principle, that the highest mountains of the continents face the largest oceans, is of wide application, and unlocks many mysteries in physical geography. South America lies between the same oceans as North America; it has its eastern low range, its western Andes; and as the oceans widen southward, the continent is there pinched up to almost a narrow mountain ridge; it differs from North America in having a large expanse of ocean, the Atlantic, on the north, and correspondingly it has its northern mountain ridge. The world is full of such illustrations, but I pass them by.

This simplicity of ocean boundary, of surface features and of outline, accounts for the simplicity of geological structure in North America; or we may make the wider statement, that all these qualities are some way connected with the position and extent of the ocean, they seeming to point to the principle that the subsidence of the oceanic basins has determined the continental features. America has thus the simplicity of a single evolved result. Europe, on the contrary, is a world of complexities. It is but one corner of the oriental continent, which includes Europe, Asia, and Africa, and while the ocean bounds it on the north and west, continental lands enclose it on the south and east. It has ever been full of cross purposes. American strata often stretch from the Atlantic west beyond the Mississippi; and east of the Rocky Mountains, it has but one proper mountain range of later date than the Silurian. Europe is much broken up into basins, and has mountains of all ages; even the Alps and Pyrenees are as recent as the tertiary. This wide contrast accounts for the greater completeness or generality of American revolutions, and the more abrupt limits of periods and clearer exhibition of many geological principles.

The geological structure of this country has been made known through the combined researches of a large number of investigators. The names of Maclure, Silliman, Eaton, lead off the roll. Hitchcock, the Professors Rogers, the well-known Geologists of the New York Survey, Owen, Percival, Morton, Conrad, Tuomey, and many others, have contributed to the collected results. Yet the system may be said to have been mainly laid open by three sets of observers—Morton and Conrad for the Cretaceous and Tertiary, the New York Geologists for the Palæozoic strata; and the Professors Rogers for the Carboniferous beds and the Appalachians.

The succession of Silurian aad Devonian rocks in the State of New York is the most complete in the country, and it was well for the science that its rocks were so early studied, and with such exactness of detail. The final display of the Palæontology by Mr. Hall has given great precision to the facts, and the system has thereby become a standard of comparison for the whole country, and even for the world. This accomplished, the carboniferous rocks were still to be registered, and the grand problem of New England Geology solved. The Professors Rogers, in the survey of Pennsylvania and Virginia, followed out the succession of strata from the Devonian through the Coal period, and thus in a general way completed the series. And more than this, they unravelled with consummate skill the contortions among the Appalachians, bringing order out of confusion, and elucidating a principle of mountain-making which is almost universal in its application. They showed that the Silurian, Devonian, and Carboniferous strata, which were originally laid out in horizontal layers, were afterward pressed on to the north-westward, and folded up, till the folds were of mountain height, and thus the Appalachians had their origin; and also, that by the escaping heat of those times of revolution extensive strata were altered or even crystallized.

This key soon opened to us a knowledge of New England Geology, mainly through the labours of Mr. Hall, and also Professor H. D. Rogers, following up the survey of Pres. Hitchcock; and now these so-called primary rocks, granite, gneiss, mica-schist, and crystalline limestones, once regarded as the oldest crystallizations of a cooling globe, are confidently set down as for the most part no older than the Silurian, Devonian, and Carboniferous beds of New York and Pennsylvania.

Let us now briefly review the succession of epochs in American Geological history.

The Azoic age tended, as was observed, in a period of extensive metamorphic action and disturbance; in other words, in a great revolution. At its close, some parts of the continent were left as dry land, which appear to have remained so as a general thing in after times; for no subsequent strata cover them. Such are a region in Northern New York, others about and beyond Lake Superior, and a large territory across the continent from Labrador westward, as recognized by Messrs. Whitney and Foster, and the geologists of Canada.

The Silurian or Molluscan Age next opens. The lowest rock is a sandstone, one of the most widely spread rocks of the continent, stretching from New England and Canada south and west, and reaching beyond the Mississippi—how far is not known. And this first leaf in the record of life is like a title-page to the whole volume, long afterward completed; for the nature of the history is here declared in a few comprehensive enunciations.

1. The rock from its thin, even layers and very great extent shows the wide action of the ocean in distributing and working over the sands of which it was made; and the ocean ever afterward was the most active agency in rock-making.

2. Moreover, ripple-marks such as are made on our present sea-shores or in shallow waters, abound in the rock both through the east and west, and there are other evidences also of moderate depth and of emerged land. They all announce the wonderful fact that even then, in that early day, when life first began to light up the globe, the continent had its existence—not in embryo, but even of full-grown extent, and the whole future record is but a working upon the same basis and essentially within the same limits. It is true that but little of it was above the sea, but equally true that little of it was at great depths in the ocean.

3. Again, in the remains of life which appear in the earliest layers of this primal rock, three of the four great branches of the animal kingdom are represented: Molluscs, Tribolites among Articulates, Corals and Crinoids among Radiates—a sufficient representation of life for a title-page. The New York beds of this rock had afforded only a few Molluscs, but the investigations of Owen in Wisconsin have added the other tribes; and this diversity of forms is confirmed by Barrande in his Bohemian researches. Among the genera, while the most of them were ancient forms that afterwards became extinct—and through succeeding ages thousands of other genera appeared and disappeared—the very earliest and most universal was one that now exists—the genus Lingula—thus connecting the extremes of time, and declaring most impressively the unity of creation. Mr. Hunt, of the Canada Geological Survey, recently discovered that the ancient shell had the anomalous chemical constitution of bones, being mainly phosphate of lime, and afterward he found in a modern Lingula the very same composition—a further announcement of the harmony between the earliest and latest events in geological history.

The earliest sandstone, called in New York the Potsdam sandstone, and the associate calciferous sand-rock, mark off the *First Period* of the Molluscan Age, the *Potsdam Period*, as it may be called.

Next followed the *Trenton Period*—a period of limestones (the Trenton limestone among them) equal to the earlier beds in geographical limits, and far more abundant in life, for some of the beds are literally shells and corals packed up in bulk; yet the species were new to the period, the former life having passed away; and even before the Trenton period closes, there were one or two epochs of destruction of life, followed by new creations. The formation of these limestone beds indicated an increase in the depth of the continental seas—an instance of the oscillation of level to which the earth's crust was almost unceasingly subject through all geological ages until the present.

After the Trenton period, another change came over the continent, and clayey rocks or shales were formed in thick deposits in New York and to the south—the Utica Slate and Hudson River Shales—while limestones were continued in the west. This is the *Hudson Period*, and with it the *Lower Silurian* closed.

The seas were then swept of their life again, and an abrupt transition took place both in species and rocks. A conglomerate covered a large part of New York and the States south, its coarse material evidence of an epoch of violence and catastrophe; and with this deposit the *Upper Silurian* begins.

The Upper Silurian has also its three great periods—the *Niagara*,

the *Onondaga*, the *Lower Helderberg*, and many subordinate epochs—each one characterized by its peculiar organic remains; each evidence of the nearly or quite universal devastation that preceded it, and of the act of omnipotence that re-instated life on the globe; each, too, bearing evidence of shallow or only moderately deep waters when they were formed; and the Onondaga period—the period of the New York salt rocks—telling of a half emerged continent of considerable extent.

Another devastation took place, and then opened, as De Verneuil has shown, the Devonian Age, or Age of Fishes. It commenced, like the Upper Silurian, with coarse sandstones, evidence of a time of violence; these were followed by another grit-rock, whose few organic remains show that life had already re-appeared. Then another change—a change evidently in depth of water—and limestones were forming over the continent, from the Hudson far westward; the whole surface became an exuberant coral-reef, far exceeding in extent, if not in brilliancy, any modern coral sea; for such was a portion, at least, of the *Upper Helderberg* period.

Again, there was a general devastation, leaving not a trace of the former life in the wide seas; and where were coral reefs, especially in the more eastern portion of the continental seas, sandstones, and shales accumulated for thousands of feet in thickness, with rarely a thin layer of limestone. Thus passed the *Hamilton*, *Chemung*, and *Cattskill Periods* of the Devonian Age. The life of these regions, which in some epochs was exceedingly profuse, was three or four times destroyed and renewed, not renewed by a re-creation of the same species, but of others; and although mostly like the earlier in genera, yet each having characteristic marks of the period to which it belonged. And while these Devonian periods were passing, the first land plants appeared, foretellers of the age of verdure next to follow.

Then come vast beds of conglomerate, a natural opening of a new chapter in the record; and here it is convenient to place the beginning of the Carboniferous, or the Age of *Acrogens*. Sandstone and shales succeeded reaching a thickness in New Jersey and Pennsylvania, according to Professor Rogers, of thousands of feet; while in the basin of the Ohio and Mississippi, in the course of this era, the carboniferous limestone was forming immense Crinoidal plantations in the seas.

Another extermination took place of all the beautiful life of the waters, and a conglomerate or sandstone was spread over the encrinital bed; and this introduced the true Coal period of the Carboniferous Age; for it ended in leaving the continent, which had been in long continued oscillations, quite emerged. Over the regions where encrinites were blooming, stretch our vast prairies or wet meadows of the luxuriant coal vegetation. The old system of oscillation of the surface still continues, and many times the continent sinks to rise again—in the sinking extinguishing all continental life, and exposing the surface to new depositions of sandstone, clays, or limestone, over the accumulated vegetable remains; in the rise depopulating the seas by drying them up, and preparing the soil for verdure again; or at times convulsive movements of the crust carry the seas over the land, leaving destruction behind. Thus by repeated alternations the coal period passes—some 6000 feet of rock and coal beds being formed in Pennsylvania, and 14,000 feet in Nova Scotia.

I have passed on in rapid review, in order to draw attention to the series or succession of changes, instead of details. So brief an outline may lead a mind not familiar with the subject to regard the elapsed time as short, whereas, to one who follows the various alternations and the whole order of events, the idea of *time immeasurable* becomes almost oppressive.

Before continuing the review I will mention some conclusions which are here suggested:

1. In the first place, through the periods of the Silurian and Devonian, at twelve distinct epochs at least, the seas on this American Continent were swept of nearly all existing life, and as many times it was repeopled, and this is independent of many partial exterminations and renewals of life that at other times occurred.

If omnipotent power had been limited to making monads for after development into higher forms, many a time would the whole process have been utterly frustrated by hot water, or by mere changes of level in the earth's crust, and creation would have been at the mercy of dead forces. The surface would have required again and again the sowing of monads, and there would have been a total failure of crops after all; for these exterminations continue to occur through all geological time into the Mammalian Age.

2. Again, I have observed that the Continent of North America has never been the deep ocean's bed, but a region of comparatively shallow seas, and at times emerging land, and was marked out in its great outlines even in the earliest Silurian. The same view is urged by De Verneuil, and appears now to be the prevailing opinion among American geologists. The depth at times may have been measured by the thousand feet, but not by miles.

3. During the first half of the Lower Silurian Era, the whole East and West were alike in being covered by the sea. In the first or Potsdam period, the Continent was just beneath its surface. In the next, or Trenton period, the depth was greater, giving purer waters for abundant marine life. Afterwards the east and west were in general widely diverse in their formations; limestones, as Mr. Hall and the Profs. Rogers have remarked, were in progress over the west; that is, the region now the great Mississippi Valley, beyond the Appalachians; while sandstones and shales were forming through north-eastern New York, south and south-west through Virginia. The former, therefore, has been regarded as an area of deeper water; the latter as in general shallow, when not actually emerged. In fact, the region toward the Atlantic border, afterward raised into the Appalachians, was already, even before the Lower Silurian Era closed, the higher part of the land; it lay as a great reef, or sand bank, partly hemming in a vast continental lagoon, where corals, encrinites and molluscs grew in profusion; thus partly separating the already existing Atlantic from the interior waters.

The oscillations or changes of level over the continent through the Upper Silurian and Devonian had some reference to this border region of the continent; the formations approach or recede from it, and sometimes pass it, according to the limits of the oscillations eastward or westward. Along the course of the border itself, there were deep subsidences in slow progress, as is shown by the thickness of the beds. It would require much detail to illustrate these points, and I leave them with this bare mention.

The Hudson River and Champlain valleys appear to have had their incipient origin at the epoch that closes the Lower Silurian; for while the preceding formations cross this region, and continue over New England, the rocks of the Niagara and Onondaga periods (the first two of the Upper Silurian) thin out in New York before reaching the Hudson River. Mr. Logan has recognized the division of America to the north-east into two basins, by an anticlinal axis along Lake Champlain, and observes also that the disturbances began as early at least as the close of the Lower Silurian, mentioning, too, that there is actually a want of conformity in Gaspè between the beds of the Upper and Lower Silurian—another proof of the violence that closed the Lower Silurian era.

But let us pass onward in our geological review. All the various oscillations that were in slow movement through the Silurian, Devonian and Carboniferous ages, and which were increasing their frequency throughout the last, raising and dipping the layers in many alternations, were premonitions of the great period of revolution, so well elucidated, as already observed, by the Professors Rogers, when the Atlantic border, from Labrador to Alabama, long in preparation, was at last folded up into mountains, and the Silurian, Devonian and Carboniferous rocks were baked and crystallized. No such event had happened since the revolution closing the Azoic period. From that time on, all the various beds of succeeding ages, up to the top of the Carboniferous, had been laid down in horizontal or nearly horizontal layers—over New England as well as in the West; for the continent from New England westward, we have reason to believe, was then nearly a plain either above or below the water; there had been no disturbances except minor uplifts; the deposits with small exceptions were a single unbroken record, until this Appalachian revolution.

This epoch, although a time of vast disturbances, is more correctly contemplated as an epoch of the slow-measured movement of an agency of inconceivable power, pressing forward from the ocean toward the north-west; for the rocks were folded up without the chaotic destruction that sudden violence would have been likely to produce. Its greatest force and its earliest beginning was to the north-north-east. I have alluded to the disturbances between the Upper and Lower Silurian beds of Gaspè to the North. Another epoch of disturbance, still more marked, preceded (according to Mr. Logan) the carboniferous beds in those north-eastern regions; and New England, while a witness to the profound character and thoroughness of the Appalachian revolution, attests also to the greater disturbance toward its north-eastern limits. Some of the carboniferous strata were laid down here in Rhode Island, as clay and sand, and layers of vegetable debris; they came forth from the Appalachian fires as you have them, the beds contorted, the coal layers a hard silicious anthracite or even graphite in places, the argillaceous sands and clays, crystallized into talcose, or even gneiss and syenite.

These very coal beds, so involved in the crystalline rocks, are part

of the proof that the crystalization of New England took place after the coal age. Fossils in Maine and Vermont add to the evidence. The quiet required over the continent, for the regular succession and undisturbed condition of the rocks of the Silurian, Devonian and Carboniferous formations, shows that in neither of those ages could such vast results of metamorphic action and upheaval have taken place.

The length of time occupied by this revolution is beyond all estimate. Every vestige of the ancient Carboniferous life of the continent disappeared before it. In Europe a Permian period passed with its varied life; yet America, if we may trust negative evidence, still remained desolate. The Triassic period next had its profusion of living beings in Europe, and over 2,000 feet of rocks. America, through all, or till its later portions, was still a blank, nor till near the beginning of the Jurassic period do we find any traces of new life, or even of another rock above the Carboniferous.

What better evidence could we have than the history of the oscillations of the surface, from the earliest Silurian to the close of the Carboniferous age, and the final cresting of the series in this Appalachian revolution, that the great features of the continent had been marked out from the earliest time? Even in the Azoic, the same north-east and south-west trend may be observed in Northern New York and beyond Lake Superior, showing that although the course of the great Azoic lands was partly east and west, the same system of dynamics was then to some extent apparent, or at least in development.

The first event in the records after the Appalachian revolution is the gathering up of the sands and fragments of the crystalized rocks and schists along the Atlantic border into beds—not over the whole surface, but in certain valleys which lie parallel with the Appalachian chain, and which are evidently a result of the foldings of that revolution. The beds are the red sandstone and shales which stretch on for 120 miles in the Connecticut Valley; and similar strata occur in South-eastern New York, in New Jersey, Virginia and North Carolina. These long valleys are believed to have been estuaries or river courses. The period of these deposits is regarded as the earlier Jurassic by Prof. Wm. H. Rogers. Dr. Hitchcock supposes that a portion of the preceding or Triassic period may be represented. Many of the layers show by their shrink-cracks, ripple marks and foot prints, as others have observed, that they were formed in shallow waters, or existed as an exposed mud flat. But they accumulated till they were over a thousand feet thick in Virginia, and in New England two or three thousand, according to the lowest estimate. Hence the land must have been sinking to a depth equal to this thickness, as the accumulations went on, since the layers were formed successively at or near the surface.

Is it not plain, then, that the oscillations, so active in the Appalachian revolution, and actually constituting it, had not altogether ceased their movements, although the times were so quiet that numerous birds and reptiles were tenants of the Connecticut region? Is it not clear that these old valleys, occurring at intervals from Nova Scotia to South Carolina, originally made by foldings of the earth's crust, were still sinking?

And did not the tension below of the bending rocks finally cause ruptures? Even so. And the molten rock of the earth's interior which then escaped through the crystaline rocks beneath and the overlying sandstone, constitutes the trap mountains, ridges and dykes, thickly studding the Connecticut Valley, standing in palisades along the Hudson, and diversifying the features of New Jersey and parts of Virginia and North Carolina. The trap is a singularly constant attendant on the sandstone, and everywhere bears evidence of having been thrown out soon after the deposition of the sandstone, or in connection with the formation of its later beds. Even the small sandstone region at Southbury, Ct., has its trap. Like the Appalachian revolution this epoch had its greatest disturbances at the North.

Thus ended in fire and violence, and probably in submergence beneath the sea, the quiet of the Connecticut Valley, where lived, as we now believe, the first birds of creation—kinds that were nameless until some countless ages afterward. Prof. Hitchcock tracked them out, found evidence that they were no unworthy representatives of the feathered tribe, and gave them and their reptile associates befitting appellations.

Such vast regions of eruptions could not have been without effusions of hot water and steam and copious hot springs. And may not these heated waters and vapors, rising up through the crystaline rocks below, have brought up the copper ores that are now distributed in some places through the sandstone? The same cause, too, may have given the prevalent red color to the rock, and produced changes in the adjoining granite.

After the era of these rocks, there is no other American record during the European Jurassic period.

In the next, or Cretaceous period, the seas once more abound in Animal life. The position of the Cretaceous beds around the Atlantic border show that the continent then stood above the sea very much as now, except at a lower level. The Mississippi Valley, which from the Silurian had generally been the region of deeper waters, was even in Cretaceous times occupied to a considerable extent by the sea—the Mexican Gulf then reaching far north, even far up the Missouri, and covering also a considerable part of Texas.

An age later, the Cretaceous species had disappeared, and the Mammalian Age (or the Tertiary, its first period,) begins, with a wholly new Fauna, excepting, according to Prof. Tuomey, some half a dozen species, about which, however, there is much doubt. The continent was now more elevated than in the preceding age, and the salt waters of the Mexican Gulf were consequently withdrawn from the region of Iowa and Wisconsin, so as not to reach beyond the limits of Tennessee.

Two or three times in the course of the Tertiary period, the life of the seas was exterminated, so that the fossils of the later Tertiary are not identical with any in the earliest beds, excluding some fish remains—species not confined to the coast waters. The crust of the earth was still oscillating; for the close of the first Tertiary epoch was a time of subsidence; but the oscillation or change of level was slight, and by the end of the Tertiary, the Continent on the east stood within a few feet of its present elevation, while the Gulf of Mexico was reduced nearly to its present limits.

[*To be continued.*]

Preparation of Aluminium.

The following are two methods given by M. St. Claire Deville, for obtaining Aluminium:—

1. Sodium Process.—Introduce into a glass tube of about an inch in diameter from 200 to 300 grammes of chloride of aluminium, closing the ends with a plug of asbestos; then conduct hydrogen gas, dry, and perfectly free from atmospheric air, into the tube, and heat the chloride of aluminium in this current of gas by means of charcoal. This will have the effect of driving off the hydrochloric acid, chloride of silicium, and chloride of sulphur, with which it is always impregnated. Capsules of as large size as possible, containing each some grammes of sodium, previously crushed between two sheets of dry filter paper, are then introduced into the glass tube. The tube being full of hydrogen, the sodium is melted; and the chloride of aluminium on being heated, will be distilled and decomposed with incandescence, which may be easily moderated. The operation will be complete when all the sodium has disappeared, and the chloride of sodium formed, has absorbed a sufficient quantity of chloride of aluminium to saturate it. The aluminium will now exist in the state of a double chloride of aluminium and sodium, which is a very fusible and volatile compound. the capsules are next to be removed from the glass tube, and placed in a large porcelain tube, furnished with a pipe leading to a receiver. Through this porcelain tube, while heated to a lively red heat, a current of hydrogen, dry and free from air, is caused to pass; and the chloride of aluminium and sodium will be thereby distilled without decomposition, and collect in the receiver. After the operation, all the aluminium will be found collected in the capsules in the form of large globules; these are washed in water, which will carry off a little of the salt produced by re-action, and also some brown silicium. In order to form a single mass of all these globules, after being cleansed and dried, they are introduced into a capsule of porcelain, into which is put, as a flux, a small quantity of the product of the preceding operation—*i. e.*, of the double chloride of aluminium and sodium. On heating the capsule in a muffle to the temperature of about the melting point of silver, all the globules will be seen to unite in a brilliant mass, which is allowed to cool, and then washed. The melted metal must be kept in a closed porcelain crucible until the vapours of the chloride of aluminium and sodium with which the metal is impregnated have entirely disappeared. The metallic mass will then be found surrounded by a light pellicle of alumina arising from the partial decomposition of the flux.

2. Process by means of Galvanism.—This process is carried on by means of the double chloride of aluminium and sodium. For this purpose the aluminium bath is prepared by taking two parts by weight of chloride of aluminium, and adding thereto one part of dry

pulverised marine salt. The whole is mixed in a porcelain capsule, heated to about 200°. The combination will soon take place, with disengagement of heat. The liquid thus obtained is to be introduced into a capsule of glazed porcelain, which is maintained at a temperature of about 200°. The negative electrode is a plate of platinum, upon which the aluminium will be deposited, mixed with marine salt, in the form of a greyish layer. The positive electrode consists of porous vessels, perfectly dry, and containing melted chloride of aluminium and sodium, in which is immersed a cylinder of charcoal, which generates the electricity, and to which pass the chlorine, and a small quantity of chloride of aluminium, arising from the decomposition of the double salt. The double fixed chloride is re-constituted, and the vapours cease. A small number of elements are necessary for decomposing the double chloride, which presents but slight resistance to the action of electricity.

When the platinum plate is sufficiently charged with metalliferous deposit, it is removed, and allowed to cool; the saline mass is then cleaned off, and the plate again introduced into the current. The matter thus detached from the electrode is melted in a porcelain crucible, which is enclosed in an earthenware one; and after cooling, it is treated with water, which dissolves a large quantity of marine salt; and a grey metallic powder is obtained, which is, by several successive meltings, formed into a single mass; the double chloride of aluminium and sodium being employed as a flux for that purpose.

The first portions of metal obtained by this process are nearly always brittle; as fine a product may, however, be obtained by it as by the sodium process; but the chloride of aluminium employed for that purpose must be purer. In fact, by the sodium process, the silicium, sulphur, and iron are carried off by means of hydrogen,—the iron passing off in the state of protochloride; whilst all these impurities remain in the liquid which is decomposed by the battery, and are carried off along with the first portions of metal reduced.

In addition to these processes of M. Deville, we have

M. Bunsen's Method of Preparation.—Take oxide of aluminium obtained either by the calcination of ammoniacal alum, or from sulphate of alumina, or by the decomposition of alum by chloride of barium; and having mixed it with charcoal, introduce the mixture into a stone retort capable of containing about two quarts, and cover it with a thick layer of cement composed of argil and iron scales. Place the retort in a reverberatory furnace, with its neck projecting horizontally therefrom, from 3 to 5 inches, and connect this neck with a glass receiver, for the reception of the chloride of aluminium, which is sublimed on the introduction of chlorine. This gas is introduced into the glass receiver by a tube of large diameter, made of glass not easily fusible. The stone retort is heated to a dull red heat, and a current of chlorine (well washed and dried) is caused to pass therein. Chloride of aluminium is then freely formed; and at the expiration of some hours the receiver will at least contain half a pound of product. When this chloride is well cooled, it is mixed with its equivalent of melted and pulverised chloride of sodium, and heat is applied thereto. The mixture will melt at a temperature below 200° centigrade. It is introduced into a closed porcelain crucible, divided into two compartments by a porcelain partition which does not quite reach to the bottom, and closed by means of a porcelain cover, having two holes for the reception of the conductors of the battery. Six or eight pairs of Bunsen's plates will suffice to separate the aluminium. If the temperature remains at 200° centigrade, the metal will be deposited in the state of powder; and, for the purpose of converting this into a compact mass, pulverised chloride of sodium is gradually introduced into the mixture, until the liquid has reached the temperature of the melting point of silver. After cooling, large balls of aluminium will be found in the mass, which are caused to unite by throwing them into melted sea salt. The ingots thus obtained possess all the characteristics of M. Deville's aluminium.

Modes of testing Building Materials.

At the last meeting of the American Association for the advancement of science Prof. Henry read a paper on the modes of testing building materials and an account of the marbles used at Washington. He had been appointed on a committee to test the material offered for the extension of the Capitol at Washington. The committee had to take into consideration many minute sources of disintegration, such as that every flash of lightning produced an appreciable amount of nitric acid, which diffused in rain water acted on the carbonate of lime, and the action of dust carried by the wind against the building. The committee subjected specimens to actual freezing and after several experiments a good method was obtained. It was found that in ten thousand years one inch would be worn from the blocks by the action of frost. Blocks of 1½ inch cube were subjected to pressure, and thin plates of lead, as had been the case in former experiments, being introduced to equalize any equalities which might occur in the surface. But upon experiment it was found that while one of these cubes would sustain 60,000 pounds without the lead plates, it would sustain only 30,000 with them. They had therefore to invent a machine to cut the sides of the block perfectly parallel, when it was found that the marble which was chosen for the Capitol, from a quarry in Lee, Massachusetts, would sustain about 25,000 pounds to the square inch. The manner of its breaking was peculiar. With the lead plate interposed, the sides which were free first gave way, leaving the pressure on two cones whose bases joined the plates, and whose apexes met each other, and that they then yielded with comparative ease. This marble absorbed water by capillary attraction, and in common with other marbles was permeable to gases. Soon after the workmen commenced placing it in the walls it exhibited a brownish discoloration although no trace of it appeared while the blocks remained in the stonecutter's yard. A variety of experiments were made with a view to ascertain the cause of this phenomenon, and it was finally concluded to be due to the previous absorption by the marble of water holding in solution organic matter, together with the absorption of another portion of water from the mortar. To illustrate the process, he supposed a fine capillary tube with its lower end immersed in water, whose internal diameter was sufficiently small to allow the liquid to rise to the top to be exposed to the atmosphere. Evaporation would take place at the upper surface of the column, and new portions of water would be drawn up to supply the loss, and if this process were continued any material which might be contained in the water would be found deposited at the top of the tube, the point of evaporation. If, however, the lower portion of the tube were not furnished with a supply of water, the evaporation at the top would not take place, and the deposition of foreign matter would not be exhibited, even though the tube itself were filled with water impregnated with impurities. The pores of the marble, so long as the blocks remained in the yard, were in this last condition, but when the same blocks were placed in the wall of the building the water absorbed from the mortar at the interior surface gives the supply of liquid necessary to carry the coloring materials to the exterior surface and deposit it there at the mouths of the pores. The cause of the phenomenon being known, a remedy was readily suggested; the interior surface of the stone was coated with asphaltum, rendering it impervious to the moisture of the mortar, and the discoloration was gradually disappearing. In a series of experiments made some ten years ago he had shown that the attraction of the particles for each other of a substance in a liquid form was as great as that of the same substance in a solid form. Consequently, the distinction between liquidity and solidity did not consist in a difference in the attractive power occasioned directly by the repulsion of heat; but it depended upon the perfect mobility of the atoms, or a lateral cohesion. He might explain this by assuming an incipient crystallization of atoms into molecules, and consider the first effect of heat as that of breaking down these crystals and permitting each atom to move freely around every other. When this crystalline arrangement was perfect, and no lateral motion allowed in the atoms, the body might be denominated perfectly rigid. We had approximately an example of this in cast steel, in which no slipping took place of the parts on each other, or no material elongation of the mass; and when a rupture was produced by a tensile force, a rod of this material was broken with a tranverse fracture of the same size as that of the original section of the bar. In this case every atom was separated at once from the other, and the breaking weight might be considered as a measure of the attraction of cohesion of the atoms of the metal. The effect, however, was quite different when we attempted to pull apart a rod of lead. The atoms or molecules slipped upon each other. The rod was increased in length and diminished in thickness until a separation was produced. Instead of lead we might use still softer materials, such as wax and putty, until we arrived at a substance in a liquid form. This would stand at the extremity of the scale, and between extreme rigidity on the one hand and extreme liquidity on the other, we might find a series of substances gradually shading from one extremity to another. According to the views he had presented, the difference in tenacity of steel and lead did not consist in the attractive cohesion of the atoms, but in their capability of slipping upon each other. From this view it followed that the form of the material ought to have some effect upon

its tenacity, and also that the strength of the article depended in some degree upon the process to which it had been subjected. He had for instance found that softer substances in which the outer atoms had freedom of motion, while the inner ones by the pressure of those exterior were more confined, broke unequally, the inner fibres, if he might so call the rows of atoms gave way first and entirely separated, while the exterior fibres showed but little indications of a change of that kind. If a cylindrical rod of lead, three-fourths of a inch in diameter were turned down on a lathe in one part to about half an inch, and then gradually broken by a force exerted in the direction of its length, it would exhibit a cylindrical hollow along its axis of half an inch in length, and at least a tenth of an inch in diameter. With substances of a greater rigidity this effect was less apparent. It existed, however, even in iron, and the interior fibres of a rod of this metal might be entirely separated, while the outer surface presented no appearance of change. From this it would appear that metals should never be elongated by mere stretching, but in all cases by the process of wire drawing or rolling. A wire or bar must always be weakened by a force which permanently increases its length without at the same time compressing it. Another effect of the lateral motion of the atoms of a soft heavy body when acted upon by a percussive force with a hammer of small dimensions in comparison with the mass of metal was that the interior portion of the mass acted as an anvil upon which the exterior portion was expanded so as to make it separate from the middle portions. Prof. Henry exhibited a portion of bar originally four feet long, which had been hammered in that way so as to produce a perforation through the whole length of its axis rendering it a tube. This fact appeared to him to be of great importance in a practical point of view, as it might be connected with many of the lamentable accidents which had occurred in the breaking of the axles of locomotive engines. These ought in all cases to be formed by rolling and not with the hammer.

CANADIAN INSTITUTE.

Council Meeting—September 8th, 1855.

The following gentlemen were provisionally* elected members of the Institute:—

John Wilson, M.P.P.	Loudon.
S. V. Wolcomb	Hamilton.
Romeo H. Stephens	Montreal.
Dr. Thomas Cawdry	Cobourg.
Rev. Mr. Geikie	Toronto.
William Hind	"
Geoffrey B. Hall	Nanticoke.
William Mercer	Simcoe.

* During the interval between the Sessions of the Institute, gentlemen desirous of becoming members may be provisionally elected by the Council, when duly proposed, and their election confirmed at the first ordinary meeting of the Institute in the ensuing Session. The formal election of members can only take place at an ordinary or general meeting of the Institute.

The following draft of a Circular from the Council addressed to the members, on the subject of a Building, was submitted, approved of, and copies ordered to be distributed:—

CIRCULAR FROM THE COUNCIL OF THE CANADIAN INSTITUTE.

The anticipated removal of the seat of Government to Toronto, and the consequent ejectment of the Canadian Institute from the rooms allotted to them in the old Government House, has forced on the attention of the Council the necessity of providing accommodation for the Institute in a building suited to the purposes for which it is established, and to the position which it has already achieved as a Provincial Scientific Institution.

In taking the requisite steps for this purpose, one great difficulty has been removed—by the gift of G. W. Allan, Esq., of a valuable site in Pembroke Street, on the Moss Park Estate; and, on application being made to the Government, two successive grants of £500 each have since been made in aid of the Building Fund.

Under these very favourable circumstances, the Council have determined upon appealing to the Members of the Institute, as well as to all persons likely to feel an interest in the success of the first purely scientific Institution founded in Upper Canada. The Council anticipate that at least £500 may be thus readily obtained, thereby increasing the Building Fund to £1500, and providing a sum which will justify them in commencing immediate operations.

The building which the Council propose to erect, is designed with a view to additions hereafter, so as ultimately to provide accommodation for the Museum, Library of Reference, Reading Room, and apartments for transacting the ordinary business of the Society; the present cost not to exceed £2,500.

It is proposed that the subscriptions be paid either at once or in the following manner—one-fourth immediately, and the remainder at six, twelve, and eighteen months thereafter; the mode of payment being at the option of the donor.

Gentlemen proposing to subscribe are requested to transmit their names, with their remittances, or a statement of the amounts they intend to subscribe, to the Treasurer, JAMES STEVENSON, Esq., Bank of Montreal, Toronto, as speedily as possible, in order to enable the Council to commence the building without delay.

Building Committee.—G. W. Allan, Esq.; D. Wilson, L.L.D.; H. Croft, D.C.L.; and F. W. Cumberland, Esq.

Toronto, September 4th, 1855.

The Secretary submitted a letter, dated 6th September, 1855, from E. Chads Hancock, Secretary of the Toronto Athenæum, enclosing certified copies of two resolutions of that body, authorizing its immediate amalgamation with the Canadian Institute, and the transfer to the latter of certain portions of its Library and Museum.

Donations since August 1st, 1855.

From the UNITED STATES PATENT OFFICE, *Washington.*

Report of the Commissioners of Patents, year 1854. Arts and Manufactures. Vol. II., Illustrations.

From the SOCIETIES, *through* Mr. ROWSELL.

The Quarterly Journal of the Geological Society, Vol. XI., Part 2, No. 42, May, 1855.

The Journal of the Royal Geographical Society, with Maps and Illustrations. Vol. 24, 1854.

From Dr. JOSEPH WORKMAN.

Insanity of King George III.; Dr. Ray.

From the AUTHOR, *through* Dr. CHEWETT.

Map of the Province of Canada, and the Lower Colonies, showing the connection by steam navigation with the United States and with Europe, by the route of the great Lakes, and showing also the connection

by Railroads and Canals with the New England and the North-western States of the Union, prepared for the Canadian Commissioners of the Paris Exhibition, by Thomas C. Keefer, C.E.

Mercator's Projection, with the Great Circle [shortest sailing] or air lines, illustrating the directions and capacities of the River St. Lawrence, from Lake Erie to the Atlantic, as a means of communication between Europo and the commercial centre of the Great West; showing also, the extension of the Northern Pacific railway route through Canada to the nearest Atlantic sea-port at Montreal. Prepared for the Canadian Commissioners of the Paris Exhibition, by Thomas C. Keefer, C.E.

From J. M. Street, Esq.

Report on the Niagara Railway Suspension Bridge, by John A. Roebling, C.E.

Mr. Allan having intimated that, in view of the possible extension of the contemplated Institute building on Pembroke Street, he proposed to add to his gift of a frontage on that street of ninety feet, a further donation of frontage northward of sixty-four feet.

It was resolved—That the Council gratefully accept of the valuable addition, and instruct the Secretary to record on the Minutes their cordial thanks for this further proof of his generous interest in the advancement of the Institute.

CANADIAN INSTITUTE BUILDING.

The attention of Members of the Institute is respectfully called to the Circular which will be found in the foregoing extracts from the Minutes of Council. The present position of the Canadian Institute is such as to warrant the Council in taking immediate steps for the erection of a suitable building, in which ample accommodation for a Museum, Reading Room, and Library of Reference may be provided. G. W. Allan, Esq., has increased his former valuable gift of a building site, 90 feet by 140, to one possessing a frontage on Pembroke Street of 154 feet and a depth of 140 feet. This munificent donation will allow of the construction of a building designed to admit of successive additions, as the means and material of the Society increase. The present number of names of members on the books of the Institute exceeds four hundred, and on the completion of several matters of detail, connected with the amalgamation of the Toronto Athenæum with the Institute, tho Library of Reference will contain about fifteen hundred volumes. The progress of the Museum has been necessarily slow, owing to tho state of uncertainty in which the Institute has been placed with respect to tho necessary accommodation for the Models, Birds, Minerals, Geological Specimens, Insects, &c., already accumulated. The condition and prospects of the Institute being thus far extremely favorable, it is to bo hoped that members will not allow the present valuable opportunity of giving material assistance to the building fund, to pass by unheeded.

Twenty-fifth Meeting of the British Association for the Advancement of Science.—Glasgow, 1855.

The Annual General Meeting for the present year of the members of the British Association, opened in the City of Glasgow on the 12th September, and continued until the following Monday (17th). The Members present included about 1200 Gentlemen and 500 Ladies. The Financial condition of the Association is represented as very favourable. The President's address was delivered in person by the Duke of Argyll. The next meeting is to be held in Cheltenham.

The following office-bearers were elected for the ensuing year: —*President*, G. R. Daubeny, M. D.; *Vice-Presidents*, The Earl of Ducie, The Bishop of Gloucester, Sir Roderick I. Murchison, B. Baker, Esq., The Rev. F. Close; *Secretaries*, Capt. Robertson, R.A., R. Beamish, Esq., W. Hugall, Esq.; *Treasurers*, J. Webster, Esq., J. A. Gardner, Esq.

The following abstracts of papers read at the different Sections are from the *Athenæum*.

On the Cuneiform Inscriptions of Assyria and Babylonia, by Colonel Rawlinson.—Col. Rawlinson began by saying he feared the vastness, as well as to a great extent the novelty, of the subject would prevent him doing it anything like justice in the very limited time he had at his disposal. The excavations which had been carried on in Assyria and Babylonia had been continued through six or seven years —they had ranged over tracts of country 1,000 miles in extent—the marbles excavated would be sufficient to load three or four ships, and the historical information contained in them would exceed ten thousand volumes in clay. Of course, in dealing with such a subject he could only select a portion of it,—and even of that he could only communicate the heads. The part to which he wished to direct their attention was the Cuneiform Inscriptions. This phrase merely signified the wedged-shaped form of writing, and was not employed in any particular language or by one particular nation. The cuneiform system of letters was a species of picture-writing, invented, not by the Semitic inhabitants of Babylon, but by those who preceded them. This writing was, however, reduced by the Semitic race to letters, and adapted to the articulation of their language. Their mode of writing consisted of several elements. There was the ideographic, or picture-writing, and the phonetic, which was eqivalent to the alphabet of their language. He had been fortunately able to obtain among the ruins of Nineveh a tablet which actually exhibited the several developments of this system of writing into a regular alphabet. The cuneiform inscriptions were divided into three branches—Persian, Scythic, and Assyrian; —and it was on the third of these that he wished to say a few words. He then proceeded to explain how the decipherment of these inscriptions had been obtained. About twenty years ago his attention had been directed to a series of inscriptions in cuneiform characters on a rock at Behistún, near Kermaixhah. The tablet was divided into three compartments, giving three different versions of the same inscription, and on the simplest of these, the Persian, he set to work, and found by comparing it with the two others that they corresponded, with the exception of two or three groups, from which, on further investigation, he made out—Hystaspes, Darius, and Xerxes. By means of these proper names he obtained an insight into the Persian alphabet, and by analyzing the names of the ancestors of Darius and Hystaspes, and obtaining a list of the tributary provinces of Persia, he managed to form the alphabet. This was, however, but the first step; the great object being to decipher the Assyrian inscription, and this could only be done by comparing it with the Persian. The tablet was situated on the face of the rock, 500 feet from the ground, with a precipice above it of 1,200 feet, and, in order to reach it, it was necessary to stand on the top rung of a ladder placed almost perpendicular. Nor was this all, for there was still the Babylonian to be copied, and it was engraved on the overhanging ledge of rock, which there was no means of reaching but by fastening tent-pegs into the rock, hanging a rope from one to the other, and, while thus swinging in mid-air, copying the inscription. An insight into the system of writing being thus obtained, the fortunate discovery of the ruins of Nineveh furnished a great mass of documents to which it might be applied. Wherever they had found tumuli, or any appearance of a ruin, trenches were sunk, galleries opened, and in almost every case they came upon the remains of inscribed tablets. Whether it was the king who wished to issue a bulletin, or a shopkeeper to make up his accounts, the same process had to be gone through of stamping it on clay tablets. The decipherment of these inscriptions led to important results in an ethnological point of view, both as indicating the race to which the writers belonged, and affording important information with reference to the habitat of races and their migrations. Among the many points which they were now enabled satisfactorily to settle, he alluded to the connexion between the Turanian and Hamic families, and to the occupation of Western Asia by the Scythic, and not the Semitic race. He also mentioned that from the inscriptions he believed it would be shown that the Queen of Sheba came from Idumea. As to the advantages conferred on geography by these discoveries, he would not attempt to give in detail the ramifications of geographical knowledge which had been thus obtained. He would proceed to the most interesting and important branch of tho subject, the historical. An erroneous impression was at one time in circulation that the information obtained from the inscriptions was adverse to Scripture. But so much was it the reverse of this, that if they were to draw up a scheme of chronology from the inscriptions, without having seen the statements

of the Scriptures, they would find it coincide on every important point. The excavations at Chaldea furnished them with inscriptions showing the names of kings, their parentage, the gods they worshipped, the temples they built, the cities they founded, and many other particulars of their reign. He then mentioned some circumstances with reference to the mound at Birs-Nimroud, which he had recently uncovered, and which he found laid out in the form of seven terraces. These were arranged in the order in which the Caldeans or Sabeans supposed the planetary spheres were arranged, and each terrace being painted in different colours, in order to represent its respective planet. Another curious circumstance with reference to this excavation was the discovery of documents enclosed in this temple. From the appearance of the place, he was enabled at once to say in what part they were placed, and on opening the wall at the place he indicated, his workmen found two fine cylinders. He also mentioned another small ivory cylinder which he had discovered, and round which were engraved mathematical figures, so small that they could hardly be seen with the naked eye, and which could not have been engraved without the aid of a very strong lens. In concluding, he said that before the British Association met next year, he hoped to be able to bring before them the decipherment of several highly important inscriptions.

On the less-known Fossil Floras of Scotland, by Mr. Hugh Miller.—Scotland has its four fossil Floras: its Flora of the Old Red Sandstone, its carboniferous Flora, its oolitic Flora, and that Flora of apparently tertiary age, of which His Grace the Duke of Argyll found so interesting a fragment, overflown by the thick basalt beds and trap tuffs of Mull. Of these, the only one adequately known to the geologist is the gorgeous Flora of the coal-measures, probably the richest, in at least individual plants, which the world has yet seen. The others are all but wholly unknown; and the Association may be the more disposed to tolerate the comparative meagreness of the few brief remarks which I propose making on two of their number—the Floras of the Old Red Sandstone and the oolite—from the consideration that the meagreness is only too truly representative of the present state of our knowledge regarding them, and that if my descriptions be scanty and inadequate, it is only because the facts are still few. How much of the lost may yet be recovered I know not; but the circumstances that two great Floras—remote predecessors of the existing one—that once covered with their continuous mantle of green the dry land of what is now Scotland, should be represented but by a few coniferous fossils, a few cycadaceous fronds, a few ferns and club mosses, must serve to show what mere fragments of the past history of our country we have yet been able to recover from the rocks, and how very much in the work of exploration and discovery still remains for us to do. We stand on the further edge of the great Floras of by-past creations, and have gathered but a few handfuls of faded leaves, a few broken branches, a few decayed cones. The Silurian deposits of our country have not yet furnished us with any unequivocal traces of a terrestrial vegetation. Prof. Nicol, of Aberdeen, on subjecting to the microscope the ashes of a silurian anthracite which occurs in Peebles-shire, detected in it minute tubular fibres, which seem, he says, to indicate a higher class of vegetation than the algæ; but these may have belonged to a marine vegetation notwithstanding. Associated with the earliest ichthysic remains of the Old Red Sandstone, we find vegetable organisms in such abundance, that they communicate often a fissile character to the stone in which they occur. But, existing as mere carbonaceous markings, their state of keeping is usually so bad, that they tell us little else than that the antiquely-formed fishes of this remote period had swam over sea-bottoms darkened by forests of algæ. The immensely developed flagstones of Caithness seem to owe their dark colour to organic matter, mainly of vegetable origin. So strongly bituminous, indeed, are some of the beds of dingier tint, that they flame in the fire like slates steeped in oil. The remains of terrestrial vegetation in this deposite are greatly scantier than those of its marine Flora; but they must be regarded as possessing a peculiar interest, as the oldest of their class in, at least, the British Islands, whose true place in the scale can be satisfactorily established. In the flagstones of Orkney there occurs, though very rarely, a minute vegetable organism, which I have elsewhere described as having much the appearance of one of our smaller ferns, such as the maidenhair spleenwort or dwarf moonwort. But the vegetable organism of the formation, indicative of the highest rank of any yet found in it, is a true wood of the cone-bearing order. I laid open the nodule which contains this specimen, in one of the ichthyolite beds of Cromarty, rather more than eighteen years ago; but, though I described it, in the first edition of a little work on 'The Old Red Sandstone' in 1841, as exhibiting the woody fibre, it was not until 1845 that, with the assistance of the optical lapidary, I subjected its structure to the test of the microscope. It turned out, as I anticipated, to be the portion of a tree; and on my submitting the prepared specimen to one of our highest authorities, the late Mr. William Nicol, he at once decided that the "reticulated texture of the transverse section, though somewhat compressed, clearly indicated a coniferous origin." I may add, that this most ancient of Scottish lignites presented several peculiarities of structure. Like some of the Araucarians of the warmer latitudes, it exhibits no lines of yearly growth; its medullary rays are slender, and comparatively inconspicuous; and the discs which mottle the sides of its sap chambers, when viewed in the longitudinal section, are exceedingly minute, and are ranged, so far as can be judged in their imperfect state of keeping, in the alternate order peculiar to the Araucarians. On what perished land of the early Palæozoic ages did this venerably antique tree cast root and flourish, when the extinct genera Pterichthys and Coccosteous were enjoying life by millions in the surrounding seas—long ere the Flora or Fauna of the coal measures had begun to be? The Caithness flagstones have furnished one vegetable organism apparently higher in the scale than those just described, in a well-marked specimen of Lepidodendron, which exhibits, like the Araucarian of the Lower Old Red, though less distinctly, the internal structure. It was found about sixteen years ago in a pavement quarry near Clockbriggs—the last station on the Aberdeen and Forfar railway—as the traveller approaches the latter place from the north. Above this grey flagstone formation lies the Upper Old Red Sandstone, with its peculiar group of ichthyic organisms, none of which seem specifically identical with those of either the Caithness or the Forfarshire beds; for it is an interesting circumstance, suggestive surely of the vast periods which must have elapsed during its deposition, that the great Old Red system had its three distinct platforms of organic existence, each wholly different from the others. Generically and in the group, however, the Upper fishes much more closely resemble the fishes of the Lower, or Caithness and Cromarty platform, than they do those of the Forfarshire and Kincardine one. In the uppermost beds of the Upper Old Red formation in Scotland, which are usually of a pale or light yellow colour, the vegetable remains again become strongly carbonaceous, but their state of preservation continues bad—too bad to admit of their determination of either species or genera; and not until we rise a very little beyond the system do we find the remains of a Flora either rich or well preserved. But very remarkable is the change which at this stage at once occurs. We pass at a single stride from great poverty to great wealth. The suddenness of the change seems suited to remind one of that experienced by the voyager when, after traversing for many days some wide expanse of ocean, unvaried save by its banks of floating sea-weed, or where, occasionally and at wide intervals, he picks up some leaf-bearing bough, or marks some fragment of drift-weed go floating past, he enters at length the sheltered lagoon of some coral island, and sees all around the deep green of a tropical vegetation descending in tangled luxuriance to the water's edge—tall, erect ferns, and creeping Lycapodaceæ; and the pandanus, with its aerial roots and its screw-like clusters of narrow leaves; and high over all, tall palms, with their huge pinnate fronds, and their curiously aggregated groups of massive fruit. In this noble Flora of the coal-measures much still remains to be done in Scotland. Our Lower Carboniferous rocks are of immense development; the limestones of Burdie House, with their numerous terrestrial plants, occur many hundred feet beneath our mountain limestones; and our list of vegetable species peculiar to these lower deposits is still very incomplete. Even in those higher carboniferous rocks with which the many coal workings of the country have rendered us comparatively familiar, there seems to be still a good deal of the new and the unknown to repay the labour of future explorers. It was only last year that Mr. Gourlie, of this city, added to our fossil Flora a new Volkmannia from the coal-field of Carluke; and I detected very recently in a neighbouring locality, though in but an indifferent state of keeping, what seems to be a new and very peculiar fern. There is a Stigmaria, too, on the table, very ornate in its sculpture, of which I have now found three specimens in a quarry of the coal-measures near Portobello, that has still to be figured and described. In this richly-ornamented Stigmaria the characteristic areolæ present the ordinary aspect; each, however, forms the centre of a sculptured star, consisting of from eighteen to twenty rays, or rather the centre of a sculptured flower of the Composite order, resembling a garden daisy. The minute petals—if we are to accept the latter comparison—are ranged in three concentric lines, and their form is irregularly lenticular. Even among the vegetable organisms already partially described and figured, much remains to be accomplished in the way of restoration. The detached

pinnæ of a fern, or a few fragments of the stems of Ulodendron or Sigillaria, give very inadequate ideas of the plants to which they had belonged in their state of original entireness.

Experimental Observations on an Electric Cable, by Mr. WILDMAN WHITEHOUSE.—After referring to the rapid progress in submarine telegraphy which the last four years have witnessed, Mr. Whitehouse said that he regarded it as an established fact that the nautical and engineering difficulties which at first existed had been already overcome, and that the experience gained in submerging the shorter lengths had enabled the projectors to provide for all contingencies affecting the greater. The author then drew the attention of the Section to a series of experimental observations which he had recently made upon the Mediterranean and Newfoundland cables, before they sailed for their respective destinations. These cables contained an aggregate of 1,125 miles of insulated electric wire,—and the experiments were conducted chiefly with reference to the problem of the practicability of establishing electric communications with India, Australia, and America. The results of all the experiments were recorded by a steel style upon electro-chemical paper by the action of the current itself, while the paper was at the same time divided into seconds and fractional parts of a second by the use of a pendulum. This mode of operating admits of great delicacy in the determination of the results, as the seconds can afterwards be divided into hundredths by the use of a "vernier," and the result read off with the same facility as a barometric observation. Enlarged fac-similes of the electric autographs, as the author calls them, were exhibited as diagrams, and the actual slips of electro-chemical paper were laid upon the table. The well-known effects of induction upon the current were accurately displayed; and contrasted with these were other autographs showing the effect of forcibly discharging the wire by giving it an adequate charge of the opposite electricity in the mode proposed by the author. No less than eight currents—four positive and four negative—were in this way transmitted in a single second of time through the same length of wire (1,125 miles) through which a single current required a second and a half to discharge itself *spontaneously* upon the paper. Having stated the precautions adopted to guard against error in the observations, the details of the experiments were then concisely given, including those for "velocity," which showed a much higher rate attainable by the magneto-electric than by the voltaic current. The author then recapitulated the facts, to which he specially invited attention:—First, the mode of testing velocity by the use of a voltaic current divided into two parts (a split current), one of which shall pass through a graduated resistance tube of distilled water, and a few feet only of wire, while the other part shall be sent through the long circuit, both being made to record themselves by adjacent styles upon the same slip of electro-chemical paper. Second, the use of magneto-electric "twin-currents," synchronous in their origin, but wholly distinct in their metallic circuits, for the same purpose, whether they be made to record themselves direct upon the paper, or to actuate relays or receiving instruments which shall give contacts for a local printing battery. Third, the effects of induction, retardation of the current, and charging of the wire, as shown autographically; and contrasted with this—fourth, the rapid and forcible discharging of the wire by the use of an opposite current; and hence—fifth, the use of this as a means of maintaining, or restoring at pleasure, the electric equilibrium of the wire. Sixth, absolute neutralization of currents by too rapid reversal. Seventh, comparison of working speed attainable in a given length of wire by the use of repetitions of similar voltaic currents as contrasted with alternating magneto-electric currents, and which, at the lowest estimate, seemed to be seven or eight to one in favour of the latter. Eighth, proof of the co-existence of several waves of electric force of opposite character in a wire of given length, of which each respectively will arrive at its destination without interference. Ninth, the velocity, or rather amount of retardation, greatly influenced by the energy of the current employed, other conditions remaining the same. Tenth, no adequate advantages obtained in a 300-mile length by doubling or trebling the mass of conducting metals. The author, in conclusion, stated his conviction that it appeared from these experiments, as well as from trials which he had made with an instrument of the simplest form, actuated by magneto-electric currents, that the working speed attainable in a submarine wire of 1,125 miles was ample for commercial success. And may we not, he added, fairly conclude also that India, Australia, and America, are accessible by telegraph without the use of wires larger than those commonly employed in submarines cables?

Remarks on the Chronology of the Formations of the Moon, by Prof. NICHOL.—Prof Nichol stated that, through the munificence of the Marquis of Breadalbane, he had been enabled to bring to bear on the delicate inquiries, whose commencement he intended to explain, a very great if not a fully adequate amount of telescopic power. A speculum of twenty-one inches, originally made by the late Mr. Ramage with the impracticable focal length of *fifty-five feet*, had, at the expense of that noble Lord, been re-ground, polished, mounted as an equatoreal, and placed in the Glasgow Observatory, in its best state only about six weeks ago. Prof. Nichol showed some lunar photographs, which indicated the great light with which the telescope endowed its focal images, and entered on other details as to its *definition*. The object of the present paper is the reverse of speculative. It aims to recall from mere speculation, to the road towards positive inquiry, all observers of the lunar surface. To our satellite hitherto those very ideas have been applied, which confused the whole early epochs of our terrestrial geology, the notion, viz., that its surface is a *chaos*, the result of primary, sudden, short-lived and lawless convulsion. We do not now connect the conception of irregularity with the history of the earth:—it is the triumph of science to have analyzed that apparent chaos, and discerned order through it all. The mode by which this has been accomplished, it is well known, has been the arrangement of our terrene mountains according to their relation to time: their relative ages determined, the course of our world seemed smooth and harmonious, like the advance of any other great organization. Ought we not then to attempt to apply a similar mode of classification to the formations in the moon,—hoping to discern there also a course of development, and no confusion of manifestation of irregular convulsion? Prof. Nichol then attempted to point out that there appeared a practical and positive mode by which such classification might be effected. It could not, in so far as he yet had discerned, be accomplished by tracing, as we had done on earth, relations between lunar upheavals and stratified rocks; but another principle was quite as decisive in the information it gave, viz., the intersection of dislocations. There are clear marks of dislocation in the moon—nay, the surface of our satellite is overspread with them. These are the rays of light, or rather bright rays, that flow from almost all the great craters as their centres, and are also found where craters do not at present appear. Whatever the substance of this highly reflecting matter, it is evidently no superficial layer or stream, like lava, but extends downwards a considerable depth into the body of the moon. In short, we have no likeness to it on earth, in the sense now spoken of, except our great trap and crystalline *dykes*. It seemed clear, then, that the intersection of these rays are really *intersections of dislocations*, from which we might deduce their chronology. Can the intersection, however, be sufficiently seen?—in other words, is the telescope adequate to determine which of the two intersecting lines has disturbed or cut through the other? Prof. Nichol maintained the affirmative in many cases, and by aid of diagrams, taken down from direct observation, illustrated and enforced his views.

Note on Solar Refraction, by Prof. PIAZZI SMYTH.—Amongst other interesting and important consequences of the dynamical theory of heat, Prof. W. Thomson having deduced the necessity of a resisting medium, the condensation of this about the sun, and a consequent refraction of the stars seen in that neighbourhood, Prof. Piazzi Smyth had endeavoured to ascertain by direct astronomical observation whether any such effect was sensible to our best instruments. Owing to atmospheric obstructions, only three observations, yielding two results, had been yet obtained; but both these indicated a sensible amount of solar refraction. Should this effect be confirmed by more numerous observations, it must have important bearings on every branch of astronomy; and as the atmosphere at all ordinary observatories presents almost insuperable obstacles, the author pointed out the advantage of stationing a telescope for this purpose on the summit of a high mountain.

ERRATUM.—The Lithographer of the Map of the Township of Colchester, which accompanied the conclusion of Major Lachlan's paper in the last number of the Journal, has introduced an error in the direction of one of the Canoe Canals, which we take this opportunity of rectifying. Instead of running straight through Round Marsh and Long Marsh, it should run due north along the borders of Long Marsh as far as the 8th Concession, and then across Roach's Marsh only, until it approached the River Canard. A drain from Round Marsh into the Canoe Canal will accomplish all that is required with respect to the drainage of Round Marsh.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—August, 1855.

Latitude, 43 *deg.* 39.4 *min. North.* *Longitude,* 79 *deg* 21. *min. West.* *Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg.				Temp. of the Air.				Mean Temp.	Tension of Vapour.				Humid'y of Air.				Wind.			Mean Direct.	Mean Vel'y	Rain in Inch.
	6 A.M.	2 P.M.	10 P.M.	Mean.	6 A.M.	2 P.M.	10 P.M.	M'N.	+ or — of the Average	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M	2 P.M	10 P.M	M'N	6 A.M.	2 P.M.	10 P.M.			
1	29·701	29·683	29·682	29·686	68°·7	73°·7	67°·8	70°·9	+ 3°·9	0·586	0·674	0·559	0·603	·87	·84	·85	·83	N b E	E b S	Calm	E 26° N	4·12	...
2	·716	·719	·721	·715	67·8	79·0	69·3	71·8	+ 4·9	·556	·642	·642	·627	85	67	92	83	N E b N	E b S	N b E	E 13 S	4·78	...
3	·750	·701	·618	·685	67·5	82·1	69·7	74·7	+ 7·8	·596	·711	·600	·665	92	67	85	81	N b W	S	S W	W 17 S	4·74	0·015
4	·619	·567	·595	·593	71·4	75·1	70·4	72·8	+ 5·9	·668	·738	·644	·681	89	87	89	87	W b N	S	E b N	S 10 E	4·45	0·380
5	·591	·526	—	—	63·7	73·7	—	—	—	·478	·526	—	—	84	66	—	—	N N E	E b S	N W b N	N 17 E	6·14	...
6	·529	·564	·611	·575	62·1	76·2	65·7	68·8	+ 2·0	·416	·500	·516	·469	76	57	84	70	N b W	S b W	N	N 43 W	6·83	...
7	·593	·618	·801	·673	56·8	72·7	61·7	65·3	— 1·4	·410	·555	·387	·434	91	71	72	72	N W	N E	E b N	E 32 N	9·47	0·020
8	·748	·540	·294	·501	61·6	68·6	67·1	65·6	— 1·1	·433	·482	·616	·509	82	72	96	83	S E b E	E	E S E	E 12 N	7·88	0·095
9	·143	·167	·295	·204	72·0	75·3	63·5	69·8	+ 3·1	·673	·488	·456	·510	89	58	80	73	S W	W	W	W 2 N	16·95	...
10	·417	·491	·582	·502	57·8	67·2	56·4	60·8	— 5·7	·347	·364	·282	·320	74	56	64	62	W	W b N	N b W	W 36 N	8·21	...
11	·639	·669	·650	·658	54·6	68·6	62·1	62·7	— 3·7	·311	·444	·463	·432	74	66	85	77	N E	E S E	E b N	E 11 S	6·79	...
12	·685	·680	—	—	64·9	72·1	—	—	—	·524	·737	—	—	87	97	—	—	N E b E	S b W	W	W 11 N	6·34	0·615
13	·777	·777	·802	·786	62·5	76·1	60·3	66·1	— 0·1	·428	·524	·275	·408	77	60	53	63	N N W	N W	N W b N	N 40 W	6·67	...
14	·837	·800	·762	·793	61·8	70·4	61·5	64·4	— 1·8	·284	·514	·389	·395	53	72	73	67	N N W	S	N	N 9 W	5·27	...
15	·715	·492	·447	·533	54·2	75·2	68·6	67·8	+ 1·6	·368	·533	·573	·517	89	63	85	78	N b E	S b E	S W	S 17 E	5·13	0·295
16	·366	·356	·428	·377	65·0	80·1	63·5	69·1	+ 3·1	·559	·594	·354	·497	93	59	62	71	S W b S	S W b W	N W	W 17 N	9·06	Inap.
17	·424	·502	·714	·560	56·4	64·8	51·1	56·9	— 9·0	·264	·218	·289	·260	59	36	79	59	W b N	W	W	W	15·45	0·035
18	·808	·875	·927	·878	47·0	62·6	50·6	53·9	—11·9	·267	·271	·264	·263	84	49	72	66	W N W	N W b W	N b W	W 35 N	8·39	...
19	30·019	·936	—	—	45·6	62·5	—	—	—	·231	·360	—	—	77	65	—	—	N N W	S E b S	E	E 42 S	4·45	...
20	29·915	·841	·797	·846	53·5	72·5	60·3	61·7	— 3·8	·315	·488	·447	·409	78	63	87	76	N b E	S S E	S S W	S 6 E	4·92	...
21	·777	·707	·711	·730	55·6	77·2	62·1	66·5	+ 1·0	·410	·551	·496	·493	95	60	91	79	N E	S	S S W	S 13 W	6·90	...
22	·714	·648	·577	·641	60·1	70·4	63·9	65·6	+ 0·3	·464	·534	·517	·513	91	74	89	84	Calm.	E b S	E b N	E 8 S	3·71	...
23	·508	·460	·508	·491	62·5	71·9	61·4	64·9	— 0·3	·513	·605	·384	·507	94	80	72	84	N b E	S W	N N W	N 44 W	3·88	...
24	·552	·565	·611	·581	54·6	73·9	61·4	64·6	— 0 4	·310	·435	·459	·420	74	53	86	72	W b N	S	S b W	S 10 W	5·74	...
25	·707	·676	·623	·665	58·9	72·7	63·2	65·6	+ 0·8	·425	·499	·529	·487	87	64	94	81	S S W	E b S	Calm	E 11 S	3·61	...
26	·610	·739	—	—	61·2	66·8	—	—	—	·483	·455	—	—	91	71	—	—	Calm.	N N W	N b E	N 14 W	9·94	...
27	·942	·875	·823	·875	48·5	59·7	48·8	52·9	—11·4	·215	·269	·273	·256	64	54	80	65	N b E	E S E	N b W	E 42 N	7·88	...
28	·810	·770	·687	·758	46·7	65·3	49·2	55·5	— 8·6	·235	·318	·302	·290	74	52	88	69	N	S b E	S E	S 42 E	4·62	...
29	·604	·446	·603	·566	45·9	68·2	60·7	60·9	— 3·0	·276	·523	·378	·395	90	78	72	75	W	S S W	N W	E 5 S	11·68	Inap.
30	·856	·879	·937	·897	50·4	62·2	50·6	54·2	— 9·4	·291	·290	·271	·274	81	53	75	67	N b W	S b E	N	N 6 W	7·54	...
31	·970	·941	·752	·865	47·9	61·1	55·3	56·1	— 7·2	·267	·361	·396	·352	81	68	93	79	N E b N	E S E	E b N	E 12 N	4·64	Inap.
M	29·672	29·642	29·650	29·653	58·2	71·2	61·0	64·1	— 1·7	0·403	0·486	0·436	0·444	·82	·64	81	·74	5·22	10·25	5·06	W 27 N	6·97	1·455

Highest Barometer...... 30·019, at 6 a.m. on 19th } Monthly range:
Lowest Barometer....... 29·130, at 8 a.m. on 9th } 0·889 inches.

Highest registered temperature 83°·5, at p.m., 3rd } Monthly range:
Lowest registered temperature 40°·0, at a.m. on 19th } 43°·5.

Mean Maximum Thermometer.............. 74°·61 } Mean daily range:
Mean Minimum Thermometer....... ...... 54°·09 } 20.52

Greatest daily range.........34°·2, from p.m. of 16th to a.m. of 17th.
Least daily range ....8°·8, from p.m. of 8th, to a.m. of 9th.

Warmest day....... 3rd. Mean temperature......74°·67 } Difference,
Coldest day......... 27th. Mean temperature......52°·93 } 21°·74.

Greatest intensity of Solar Radiation, 98°·4 on p.m. of 4th } Range,
Lowest point of Terrestrial Radiation, 30°·2 on a. m. of 19th } 68°·2.

Aurora observed on 5 nights: viz. on 4th, 14th, 17th, 18th and 23rd.
Possible to see Aurora on 24 nights. Impossible on 7 nights.
Raining on 7 days. Raining 8·1 hours; depth, 1·455 inches.
Mean of Cloudiness, 0· 44.
Thunder storms occurred on the 4th, 16th, and 31st.
Sheet lightning observed on the 8th and 15th.
In observing for the periodic appearance of Meteors considerable numbers were noted on the nights of the 11th and 13th.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1795·01	1899·31	1443·32	1208·52

Mean direction of Wind, W 27° N. Mean velocity 6·97 miles per hour.
Maximum velocity, 32·6 miles per hour, from 1 to 2 p.m. on 17th.
Most windy day, the 9th; mean velocity, 16·95 miles per hour.
Least windy day, the 22nd; mean velocity, 3·71 " "
Most windy hour, 1 p.m.; Mean velocity, 10·47 miles per hour.
Least windy hour, 1 a.m.; Mean velocity, 4·78 " "
Mean diurnal variation, 5·69 miles.

16th. 5·30 to 6·20 a.m., violent *Thunderstorm*, the quantity of rain which fell in this storm was 0·295 inch. on the surface, and the velocity of the wind, from 6·12 to 6.18 a.m. attained the rate of 75·0 miles per hour.

17th. 6·45 to 7·05 p.m. very perfectly defined double *Rainbow*, beautifully exhibiting the prismatic colours.

26th. 7·54 p.m. a *Meteor* about three times as large as Jupiter observed in S.W., leaving a train of light behind it, which lasted fully a minute after the disappearance of the meteor.

The Mean Temperature of this month has been 2°·1 below the average, and the quantity of Rain has been less than the Mean by 1·264 inch. on the surface, whilst the velocity of the Wind has been in excess of the average by 2·39 miles per hour. The month may therefore be characterized as cold, clear, dry and windy.

Comparative Table for August.

Year.	Temperature.					Rain.		Wind.		
	Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	D's.	Inch.	M'n Direc.	Mean Velocity in Miles.	
1840	64·7	—1·5	80·1	47·4	32·7	12	2·905	...	...	
1841	64·4	—1·8	83·5	46·7	36·8	9	6·170	...	0·19	lbs.
1842	65·7	—0·5	80·7	45·3	35·4	6	2·500	...	0·30	lbs.
1843	66·4	+0·2	85·5	44·4	41·1	4	4·850	...	0·12	lbs
1844	64·3	—1·9	82·5	44·3	38·2	17	impt.	...	0·16	lbs.
1845	67·9	+1·7	82·5	44·4	38·1	9	1·725	...	0·19	lbs.
1846	68·4	+2·2	86·3	50·4	35·9	9	1·770	...	0·17	lbs.
1847	65·1	—1·1	83·1	44·9	38·2	10	2·140	...	0·19	lbs.
1848	69·2	+3·0	87·5	49·3	38·2	8	0·855	S 20 E	4·55	Miles.
1849	66·3	+0·1	79·5	51·4	28·1	10	4·970	W 19 N	3·76	Miles.
1850	66·8	+0·6	84·2	43·0	41·2	13	4·355	N 15 E	4·46	Miles.
1851	63·6	—2·6	79·8	43·6	36·2	10	1·360	W 27 N	4·62	Miles.
1852	65·9	—0·3	81·2	46·7	34·5	9	2·695	E 20 N	3·30	Miles.
1853	68·6	+2·4	91·6	47·6	44·0	11	2·575	S 29 E	4·23	Miles.
1854	68·0	+1·8	98·1	47·0	51·1	5	0·455	W 28 N	4·74	Miles.
1855	64·1	—2·1	82·1	44·9	37·2	7	1·455	W 27 N	6·97	Miles.
									0·19	lbs.
M'n.	66·21		84·26	46·33	37·93	9.3	2·719		4·58	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——August, 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inches	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	29.974	29.826	29.959	68.9	89.0	68.6	.496	·617	·552	·72	·46	·81	N E	N E b E	E N E	0·00	3·04	0·95	...	Clear.	Clear.	Cum. Str. 4.
2	30.010	.941	.955	65.5	93.4	74.0	555	607	648	89	44	78	N E b E	S	S W	2·19	0·37	0·62	...	Do.	Do.	Str. 2.
3	29.970	.929	.817	73.9	89.4	73.9	692	751	692	86	56	85	S W	S W	S W	3·17	3·67	4·28	...	Do.	Str. 2.	Cum. Str. 2.
4	.685	.712	.868	72.0	82.1	68.0	670	692	496	86	64	72	W	N E	N E	5·02	2·97	10·08	...	Cir. Cum. Str.	Cum. Str. 2.	Do. 2.
5	.781	.750	.702	50.0	82.0	62.8	312	727	445	84	68	79	N E	S W b S	S W b S	0·16	0·53	Inap.	...	Clear. [10.	Do. 4.	Clear, ft. aurora.
6	.782	.705	.816	55.2	78.5	59.7	372	473	358	84	50	71	N b E	W S W	N W b W	2·67	1·34	5·63	...	Do.	Do. 2.	Do.
7	.850	.824	.946	54.3	68.0	52.1	349	646	349	81	94	87	N W b N	N E b E	N E b N	Inap.	Inap.	Calm	0·436	Cirr. Str. 8.	Rain.	Do.
8	30.000	.994	.690	51.2	69.9	60.1	361	461	441	93	65	84	W S W	S b E	S b E	Inap.	0·42	4·02	...	Clear.	Cir. Cum. Str. 4.	Str. 10.
9	29.301	.199	.201	62.1	66.0	66.0	546	615	580	99	95	90	S	W b N	W b S	9·62	3·61	4·50	0·530	Rain.	Rain with Thun.	Do. 8.
10	.369	.495	.700	58.0	65.0	52.2	346	449	349	70	72	87	W	W N W	N W b W	15·62	14·18	10.31	...	Clear.	Cir. Cum. Str. 5.	Clear, ft. aurora.
11	.896	.909	.952	60.0	80.4	61.1	421	532	456	80	53	84	W N W	S	S E	0·38	0·21	0·14	...	Do.	Cum. Str. 2.	Str. 2, do. do.
12	.966	.907	.854	64.7	81.1	68.8	476	670	613	79	64	89	S	S b E	S E	Inap.	2·26	2·06	Inapp.	Cir. Str. 4.	Do. 6.	Str. 10.
13	.844	.812	.904	66.1	79.4	64.4	621	628	476	99	64	79	N W b W	W	W	2·00	3·93	5·15	0·876	Cum. Str. 4.	Clear.	Do. 8.
14	30.001	30.012	30.023	52.2	76.4	56.9	357	568	363	89	64	79	W N W.	W b N	W b N	Inap.	8·37	Calm	...	Clear.	Do.	Clear.
15	29.945	29.733	29.651	45.3	82.4	67.4	292	568	626	93	53	98	W b N	S b E	N W b W	Calm	4·30	2·18	0·233	Do.	Cir. Cum. Str. 4.	Rain.
16	.560	.462	.524	70.1	83.1	73.0	628	787	692	86	71	86	S S W	W S W	S W b W	0·93	5·00	4·93	0·856	Str. 4.	Cum. Str. 4, thu.	Do.
17	.491	.480	.696	65.4	74.3	55.0	555	481	312	89	58	70	W b S	S W	W	2·01	7·50	13·50	0·950	Cirr Str. 6.	Do. 2.	Cir. Str. 4, ft. A.B.
18	.894	.927	30.031	52.7	64.0	50.6	304	363	326	76	61	87	W	W	W	11·23	11·21	6·14	Inapp.	Cirr. 2.	Do. 4.	Clear.
19	30.121	30.090	30.123	43.2	71.6	55.6	272	458	372	92	60	84	W	S W	W S W	Inap.	3·62	2·31	...	Clear, Frost.	Cir. 2.	Do.
20	30.062	30.122	30.007	53.1	76.6	63.0	352	541	491	83	61	85	S W b S	W S W	S W b W	1·05	4·33	3·50	...	Cum. Str. 4	Clear.	Cum. Str. 4.
21	29.912	29.860	29.881	63.6	83.2	70.6	516	715	568	89	64	78	W S W	W S W	S W	0·88	7·50	8·50	...	Clear.	Do.	Do. 4.
22	.928	.857	.847	67.6	79.2	64.6	593	692	565	89	71	94	S W	N W b W	N E	Calm	1·68	3·68	...	Cum Str. 9.	Cir. Cum. Str. 9.	Do. 10.
23	.693	.688	.629	64.1	81.7	68.6	576	704	646	96	68	94	N E	W S W	W b S	0·75	Inap.	0·24	...	Fog.	Cum. Str. 6.	Do. 4, Aur. B.
24	.672	.680	.800	66.1	82.2	54.0	526	660	373	82	62	87	W b S	S S W	N W	Inap.	1·35	5·39	...	Clear.	Do. 6.	Clear.
25	.983	.907	.916	60.6	80.5	63.4	467	617	488	89	61	84	E N E	E b S	E b N	2·12	2·01	1 11	...	Do.	Clear.	Cir. Str. 4.
26	.714	.815	30.090	70.6	75.2	51.5	541	523	274	74	61	71	S S W	W N W	N	4·00	13·90	8·31	0·173	Do.	Cum. Str. 4, thu.	Light Cum. 2.
27	30.193	30.089	30.048	40.5	67.4	43.5	227	366	272	86	55	90	N N E	E N E	S	4·06	3·10	Calm	...	Clear, Frost.	Clear.	Clear.
28	30.023	29.938	29.916	36.0	73.4	56.0	192	489	385	83	61	84	S b E	S	S b W	Calm	·0·25	0·19	...	Do. do.	Do.	Do.
29	29.721	.624	.561	54.5	70.0	61.0	373	568	511	87	78	94	S b W	W b S	N W b W	Calm	7·74	9·40	...	Do.	Cir. Str. 7.	Rain.
30	.954	.960	30.049	47.0	57.1	40.1	252	249	241	74	52	88	N W b W	N W b W	N W b W	6·29	12·31	9·12	0·170	Do.	Cir. Cum. 4.	Clear.
31	30.199	30.083	30.067	39.4	65.3	52.6	234	361	349	91	58	87	N W b W	W b S	S W	Calm	0·84	0·78	0·142	Do.	Cir. Cum. Str. 4.	Rain.

Barometer ....
- Highest, the 31st day .... 30·199
- Lowest, the 9th day .... 29·199
- Monthly Mean .... 29·862
- " Range .... 1·000

Thermometer
- Highest, the 2d day .... 97°·0
- Lowest, the 31st day .... 32°·2
- Monthly Mean .... 64°·94
- " Range .... 64°·8
- Mean Humidity .... ·778

Greatest Intensity of the Sun's Rays .... 132°·8
Lowest Point of Terrestrial Radiation .... 30°·2
Amount of Evaporation, 3·80 inches.

Rain fell on 11 days, amounting to 4·366 inches, and was accompanied by thunder on three days. Raining 34 hours. 40 minutes.
First Frost on the 19th day.
Most prevalent Wind, W. Least prevalent Wind, S b E.
Most Windy Day, the 10th day; mean miles per hour, 13·37.
Least Windy Day, the 7th; mean miles per hour, 0.00.
Aurora Borealis visible on 5 nights. Might have been seen on 20 nights.

The electrical state of the atmosphere has been marked by a moderate intensity of a positive character; and during the storms of thunder indicated a negative character.
Ozone.—The amount of Ozone was in rather large quantity during the month.
The Temperature of the month was 3°·37 lower than that of last August, and the monthly range was also 16°6 minus that of last August.

The Canadian Journal.

TORONTO, NOVEMBER, 1855.

Meeting of the British Association at Glasgow.

THE PRESIDENT'S ADDRESS.

Gentlemen of the British Association,—I know, that the duty of presiding over this Meeting of the British Association for the Advancement of Science, has been assigned to me mainly in consequence of my local connexion with the district and city in which we are now assembled. It cannot therefore be departing from the special duty of that position if I address you in the first place as one of those who are receiving the honour of your visit. I am sure I cannot express in terms too warm the feelings of this great community. It would be strange, indeed, if Glasgow did not hold out to you a cordial reception. Here, if anywhere, we have reason to honour Science, and to welcome the men whose lives are devoted to its pursuit. The West of Scotland has itself contributed not a few illustrious names to the number of those who have enlarged the boundaries of knowledge, or have given fruitful application to principles already known. I need not dwell on the fact that it was in this valley of the Clyde that the patient genius of Watt perfected the mechanism which first gave complete control over the powers of steam; and that it was on these waters too that those powers were first applied in a manner which has given new wings to commerce, and is now affecting not less decisively the terrible operations of war. These are but single examples, more striking and palpable than others of the dependence of the Arts upon the advance of Science. This, however, is a dependence which I am sure the citizens of Glasgow would be the first to acknowledge, and which no doubt, with them as with all men, must be an important element in the value which they set upon physical research. But I am sure I should deeply wrong the intelligence of the people of Glasgow, if I were to represent them as measuring the value of science by no other standard than its immediate applicability to commercial purposes. They seek to honour science for its own sake, and to encourage the desire of knowledge as in itself one of the noblest instincts of our nature.

It is my duty also, Gentlemen, to speak on behalf of a special body—one of which Glasgow has so much reason to be proud—I mean its ancient and venerable University. If the mechanical arts owe to this district of Scotland, the greatest impulse they have ever yet received, it is not less true that our knowledge of the laws which regulate the pursuits of industry, and determine the distribution of the "wealth of nations," has been almost founded on the researches of one whose name is indissolubly associated with this seat of learning. Here again we have an illustrious example of the mutual relations between science and politics in its best and highest definition. But, indeed, our convictions are independent of such examples. It is impossible to appreciate too highly the influence which science is evidently destined to have on the prospects of education; and we look for the time when its methods, as well as its results, will form the subject of teaching, not only as partially it has long done in our colleges, but also in the humblest of our schools. I feel it to be no small privilege arising out of the academical office which this year I have the honour of holding, to be able to assure you, on behalf of the University of Glasgow, of the deep interest with which we regard your visit, and of our high appreciation of the ends which it is your object to promote.

It is now fifteen years since the last Meeting of the British Association here. There are probably few, even annual, meetings of any considerable body of men, which are not marked by some melancholy recollections. Still more must this be the case after the lapse of so long an interval,—one which measures, as is usually reckoned, full half a generation in the life of man. Among the many vacancies in your ranks which that period has occasioned there are some which, from local association or from other causes, are naturally impressed more deeply on the mind than others. I am sure that one venerable name will rise to the memory of all who took any interest in the proceedings of 1840;—of one whose early tastes for natural science had only yielded before his devotion to a yet higher service; but whose powerful mind still sought to found all his efforts in the cause of religion and humanity on obedience to the eternal laws, which are as sure and steady in their operation over the minds of men, and over the progress of society, as are other laws over the subjects of material change. Who can forget the zeal and more than youthful eagerness with which Dr. Chalmers entered into the discussions of the Statistical Section; and how he saw in those discussions the means of spreading the knowledge of principles which are of vital interest to the welfare of the State!

But that name, though the lapse of years has not carried it beyond the region of regret, is one with which we have at least become familiar as belonging to the number of the departed great. Such is not the case with other vacancies, and especially with one which is still affecting us with almost bewildered sorrow, and an abiding sense of irreparable loss. Who shall take up the torch which has fallen from the hand of Edward Forbes? Who shall hold it as he held it to those dark places in the history of life which science is striving, perhaps in vain, to penetrate, but which seemed already opening their treasures to his fine and advancing genius?

But whilst sad recollections are thus forced upon us as regards the life of individual men, we have every reason to be satisfied with the inheritance they have left. Many labourers are gone, but the cause in which they laboured has been steadily gaining ground. Long as fifteen years may be as a period in human life, it is generally but a fraction in the history of mental progress. Yet since the last Meeting of the British Association here, I am greatly mistaken if we cannot mark great strides in the advance of science. I wish, Gentlemen, you had a President more competent than I am to chronicle that advance, and direct the retrospect to a practical and useful end. There are, however, some features so remarkable that I cannot omit referring to them, as well calculated to raise our hopes and stimulate our exertions. In that science which is the oldest and most venerable of all, I mean Astronomy, if there had been nothing else to mark the progress of discovery, the construction and application of Lord Rosse's Great Reflector would have been enough to constitute an important epoch. Its systematic operations may be said to be still only in the first stages of their progress; yet already how often do we see reference had to the mysterious revelations it has made in discussions on the principles of that science, and in not a few of the speculations to which they are giving birth! My distinguished friend Sir D. Brewster, in his recent Life of Newton, has designated that telescope as "one of the most wonderful combinations of art and science which the world has yet seen."

All who are interested in the devotion of abilities, of means and of leisure to the noblest pursuits, must earnestly wish to see Lord Rosse rewarded by that which he will value most, the steady progress of discovery. It must always be remembered, however, that Astronomy is a science of which hitherto at least it might almost be said that one great genius had left us no more worlds to conquer; that is to say, he carried our knowledge at a bound to one grand, and apparently universal law, to which all worlds were subject, and of which every new discovery had been but an additional illustration. The reign of that law, whether universal or not, was at least so wide, that we had never pierced beyond the boundary of its vast domain. For the first time since the days of Newton a suspicion has arisen in the minds of astronomers that we have passed into the reign of other laws, and that the nebular phenomena revealed to us by Lord Rosse's telescope must be governed by forces different from those of which we have any knowledge. Whether this opinion be or be not well founded—whether it be or be not probable that our limited command over time and space can ever yield to our research any other law of interest or importance comparable with that which has already been determined—still, inside that vast horizon there are fillings-in and fillings-up which will ever furnish infinite reward to labour. Of these, not a few have been secured since our last meeting here. Besides the patient work of our professed astronomers, and the good service rendered by such men as Mr. Lassell and Mr. Nasmyth, who have so well relieved the business of commercial industry by their devotion to the pursuits of science, we have had one event so remarkable, that in the whole history of astronomy it stands alone. If in looking at the wonderful objects revealed to us in Lord Rosse's telescope we turn instinctively sometimes from the thing shown to the thing which shows—from the Spiral Nebulæ to the knowledge and resources which have collected their feeble light, and brought their mysterious forms under the cognizance of the human eye,—how much more curiously do we turn from the single planet Neptune, to that other instrument which has *felt*, as it were, and found its obscure and distant orbit! So long as our species remains, that body will be associated with one of the most glorious proofs ever given of the reach of the human intellect;—of the sweep and certainty of that noble science which now honours with enduring memory the twin names of Adams and Leverrier.

In Geology, the youngest, but not the least vigorous of the sciences, every year has been adding to the breadth of its foundation—to the depth and meaning of its results. Probably no science has ever advanced with more rapid steps. In 1840 the then recent publication of the "Silurian System" had just established those landmarks of the Palæozoic world which all subsequent discovery has only tended so confirm. The great horizons which were first defined by the labours of Murchison and Sedgwick have since disclosed the same phenomena which they so accurately described, in every quarter of the globe; and the generalisations founded thereupon have been definitely established. The same period has sufficed, partly by the labours of the same distinguished men, to clear up the relative position of the strata which represent the closing epochs of ancient life, and those which form the base of the secondary age. But above all, the last few years have seen immense progress made in our knowledge of that vast series of deposits which usher in the dawn of existing forms, and carry us on to those changes, which, though the most recent, are not the least obscure of any which have affected the surface of the globe. The investigations of Edward Forbes on the laws which determined the conditions of Marine Zoology have supplied us with data altogether new on some of the highest conclusions of the science; whilst his profound speculations on the centres of creation and areas of distribution have pointed out paths of inquiry which are themselves of inexhaustible interest, and hold out the promise of great results. Another branch of investigation, which, if not entirely new, is as least pursued on a new system, and with new resources, has been opened up in Dynamical Geology by the learning and ingenuity of Mr. Hopkins; whilst the thorough elucidation of the conditions of Glacier Motion, which we owe to Prof. James Forbes, of Edinburgh, has given us clear and definite ideas in one, and that not the least important of the agents in geological change. The observations accumulated during the recent Arctic voyages have materially added to our knowledge of the operation of the same agency under different conditions—conditions which we know must once have extended widely over the firths and estuaries near where we are now assembled—leaving behind them those enduring records of the glacial epoch which were first explored by my friend, Mr. Smith, of Jordan Hill. We owe many important observations on the same phenomena, and on the various changes of sea-level, to Mr. Robert Chambers. And if the thanks of science are due to those who advance her interests, both directly by adding to her store of facts or of her discovered laws, and also indirectly by investing them with popular interest, and thus enlarging the circle of observers, we must mention with special gratitude the classical works of Mr. Hugh Miller; and those writings of Sir Charles Lyell, which his indefatigable industry is ever bringing up abreast with the progress of discovery—a progress stimulated in no small degree by his own exertions,—and which are alike remarkable for completeness of knowledge, for fertility of suggestion, and for sound philosophical reasoning. I think we cannot mistake the general tendency of Geological research, whether Stratigraphical or Zoological. It has been to prolong periods which had been considered short; to divide others which were classed together; to fill up spaces which were imagined blank, and to connect more and more in one unbroken chain the course of physical change and the progress of organic life.

We pass from geology by a natural transition to another science which stands to it in close alliance If all our most sure conclusions respecting the superficial covering of the globe have been founded on the classification of its animal remains, it is not less true that our knowledge and understanding of organic structure have been infinitely extended by the means which geology has afforded of studying that structure in relation to its history in past time. In the hands of our great countryman, Prof. Owen, Physiology has assumed a new rank in science, leading us up to the very threshold of the deepest mysteries of Nature. If the last few years had been marked by no other event in the advancement of science, there would have been enough to signalize them in the publication of his treatise on the "Homologies of the Vertebrate Skeleton:" and we may recollect with pride the fact of that high argument having been first opened at a Meeting of the British Association.

A sad interest, indeed, attaches, in one direction at least, to the progress of our knowledge in Geography. All serious doubt seems to have closed now over the grave of Franklin. Even in a year during which war has been claiming the noblest victims by thousands and tens of thousands, it would ill become this Association not to mark with an expression of our sorrow and admiration the self-sacrifice of that gallant band which has perished in the cause of science. But their devotion has been

emulated, under a still higher stimulus, in the more successful career of others; and at last, in the discovery of the North-West Passage (still so-called in spite of its having been found impassable), the courage and endurance of Capt. M'Clure and his associates have ascertained with certainty a most remarkable fact in the physical conformation of the globe. Results of still larger, and certainly of more immediate interest, are being arrived at by the rapid march of African exploration,—not, surely, before the time. Every part of the *circumference* of that vast continent has been either known or accessible to us for centuries. On its soil has flourished some of the most ancient and famous monarchies; and one of its great valleys is the fatherland of science. Yet up to comparatively recent times our horizon there has been bounded by the same sands or mountains which bounded the knowledge of antiquity, and we had almost as little acquaintance with its interior as had the Tyrian merchant when his eye rested of old on the peaks of Atlas. Nothing but familiarity with the fact could have reconciled us to the ignorance in which we have so long remained of one of the largest and most interesting regions of the world. That ignorance is at last being cleared away; and the exertions of many individuals, amongst whom the names of Mr. Galton, of Mr. Anderson, Dr. Livingston, Dr. Baikie, and Dr. Barth stand conspicuous, have contributed results of the deepest interest and importance. No man who values science can fail to appreciate the extension of our knowledge respecting geography even where, as in the Arctic regions, that knowledge is pursued simply for its own sake. But it becomes invested with tenfold interest when it brings with it the largest influence on the destinies of millions of the human race; and adds, as we may confidently hope it will ultimately do in the case of Africa, an inexhaustible field for manufacturing and commercial enterprise.

In connexion with the diffusion of geographical knowledge I cannot omit to mention the magnificent publications of Mr. Alexander Keith Johnston of Edinburgh, in his "Atlas of Physical Geography.' It is seldom that such a mass of information has been presented in a form so beautiful and attractive; or one which tends so much to place the study of geography on a truly scientific basis—that is to say, on the basis of its relation to the other natural sciences, and those grand cosmical views of terrestrial phenomena which have found their most distinguished interpreter in Baron Humboldt.

The kindred science of Ethnology has received of late years great development; not only by its increasing store of facts, but by the more scientific use which is being made of facts which have been long familiar. The investigation of the laws which regulate the growth of language, promise to cast the most important lights on the history of our race; but the conclusions to which that investigation may lead are still matters of keen and anxious controversy, and are exposed to all that suspicion which has been directed against almost every science at some stage or other of its growth; and which, we must allow, every science has, at some stage or other, justified by hasty generalisation and premature deduction.

Of all the sciences Chemistry is that which least requires to have its triumphs recorded here. The immediate applicability of so many of its results to the useful arts has secured for it the watchful interest of the world; and every day is adding some new proof of its inexhaustible fertility. There is one department of inquiry, and that perhaps the most interesting of all, I mean Organic Chemistry, which has received an especial impulse during the last few years, an impulse mainly due to the genius of one distinguished man whom we have the honour of numbering among our guests upon this occasion. I think Baron Liebig will find in Scotland that kind of welcome which a man of science values most,—a readiness to profit by his instructions, and an enlightened appreciation among the farmers of the country of the practical value of studying in their husbandry the laws which have been revealed by his research. I am reminded, through the kindness of Dr. Lyon Playfair, of some facts which give yet a more special interest to this subject in connexion with our meeting here. It was to the British Association at Glasgow in 1840 that Baron Liebig first communicated his work on the Application of Chemistry to Vegetable Physiology. The philosophical explanation there given of the principles of manuring and cropping gave an immediate impulse to agriculture, and direct attention to the manures which are valuable for their ammonia and mineral ingredients; and especially to guano, of which in 1840 only a few specimens had appeared in this country. The consequence was that in the next year, 1841, no less than 2,881 tons were imported; and during the succeeding years the total quantity imported into this country has exceeded the enormous amount of 1,500,000 tons. Nor has this been all: Chemistry has come in with her aid to do the work of Nature, and as the supply of guano becomes exhausted, limited as its production must be to a few rainless regions of the world, the importance of artificial mineral manures will increase. Already considerable capital is invested in the manufacture of superphosphates of lime, formed by the solution of bones in sulphuric acid, the use of which was first recommended at the last Glasgow Meeting. Of these artificial manures not less than 60,000 tons are annually sold in England alone; and it is a curious example of the endless interchange of service between the various sciences that Geology has contributed her quota to the same important end; and the exuviæ and bones of extinct animals, found in a fossil state, are now, to the extent of from 12,000 to 15,000 tons, used to supply annually the same fertilizing materials to the soil. The exertions of Prof. Daubeny of Oxford on the same important subject, and the continued attention which he has devoted to it, have done much for the cause of agricultural chemistry in England; whilst the thanks both of practical and of scientific men are due to Dr. Lyon Playfair and Prof. Gregory of Edinburgh, for those admirable translations of Baron Liebig's works, which have rendered them accessible to every English reader; and have thereby had no unimportant influence in extending the knowledge of the laws affecting both vegetable and animal physiology.

I am indebted to the same quarter for the mention of one remarkable instance of the manner in which—to use Dr. Playfair's words—"the overflowings of Abstract Science pass into and fertilize the field of Industry." One of the newest and most obscure subjects of chemical research has been the discovery of certain conditions under which bodies, like in their composition, are nevertheless endowed with unlike properties, and thereby become convertible to new purposes. It is in the application of this principle that a gentleman of this city, Mr. James Young, has succeeded in obtaining the illuminating principle of coal gas either in a solid or liquid state; and it has proved to be a substance of immense value for the lubrication of machinery, vast quantities of it being now manufactured and sold for that purpose.

I hardly know whether it is strictly in connexion with the advance of chemical knowledge that I ought to remind you of one great discovery made long after we last assembled here;—I refer to the discovery of the effects of chloroform on the animal system; one which claims for my friend Dr. Simpson of

Edinburgh a high place indeed among the benefactors of mankind. Chloroform as a mere chemical composition had indeed been known before, and had been made the subject of elaborate research by the distinguished French chemist, M. Dumas, whom we have here the honour of receiving as a guest. But the discovery of its application is not the less a triumph of science, and of the best and highest scientific faculties. Seldom indeed has that disposition of mind which is ever ready to receive a chance suggestion, and to pursue it believing what great things we have yet to learn, been crowned with a more brilliant and direct reward.

It marks the growing sense entertained of the value of Statistical research, that, during the late session of Parliament, a committee of the House of Lords sat for a considerable time on the best means of securing a complete system of Agricultural Returns. We owe much in this matter to the exertions of the Highland Society of Scotland, and, as has been specially recorded by the committee, to the zeal and activity of their able secretary, Mr. Hall Maxwell. We owe not less, also, to the high intelligence of the farmers of Scotland generally, who have rendered every assistance in their power, and that with a willingness which can only arise from an enlightened appreciation of the great object to be gained by the inquiry.

No one has rendered more important service to Statistical science, in one of its most interesting departments, than the able Chamberlain of this city, Dr. Strang. His periodical Reports on the Growth and Progress of Glasgow are among the most curious and useful records of the kind which have been published in any part of the United Kingdom. I need hardly say that they supply materials for much reflection on many questions connected with the social welfare of the people. I believe Dr. Strang has lately visited Paris, with a view to communicate to this Meeting of the Association various facts connected with the great improvements which are in the course of progress in that city. Should his investigations cast any light on the best means of improving the dwellings of the labouring classes in the great centres of population, and on the possibility of doing so on a large scale, by public authority, he will have rendered no small service to his country in a matter of vital interest and of much difficulty.

Closely connected with the subject of Statistics, as applied to Agricultural returns, I am happy to say that, mainly owing to the exertions of Sir J. Forbes of Fettercairn, and of Mr. Milne Home, a Meteorological Society for Scotland has been established, warmly seconded by the Highland Society. The wonderful results on a great scale which have been obtained in this department of science by Lieut. Maury, of the United States, give us ground to hope that even on the small areas of individual countries, where of course, from the crossing of local influences, the general result is infinitely complicated, some approach may be made towards ascertaining the laws which regulate the seasons.

The admirable agency which is now afforded by the Kew Committee of this Association, for the verification of instruments, and by the new meteorological department of the Board of Trade under Capt. Fitz-Roy, for the deduction of local observations, will, I trust, be taken advantage of by the new Scottish Society. I cannot help congratulating the Association on the position which has been secured by science in connexion with both of these establishments. The thanks of the commercial as well as of the scientific world are due to Colonel Sabine and the other members of the Kew Committee, whose assistance is now highly appreciated by practical men, and eagerly sought for by the best instrument-makers; whilst Capt. Fitz Roy's office and duties are in themselves an acknowledgment of no small importance of the public value of systematic observation.

The increasing employment of iron in ship-building has brought into corresponding notice the uncertainty which attends the action of the compass on board vessels of that construction. This important and intricate subject has been treated of by Mr. Archibald Smith, of Jordan Hill, with all the resources of his high mathematical and scientific attainments, in publications which have appeared under the sanction and with the recommendation of the Admiralty. It will not fail to interest this great commercial city, whose freights are on every sea, that this question was taken up at the last Liverpool Meeting by Dr. Scoresby, that it has continued to occupy his close attention, and that he intends to communicate to this Meeting of the Association some of the valuable results of his investigation.

Feeling deeply, as I do, my own inability to give anything like an adequate sketch—even in outline—of the progress of science during the last few years, I remember at the same time with some satisfaction, that it is less the business of this Association to boast of the achievements which have already been effected, than to devise means of facilitating those which are yet to come. You have appointed a Parliamentary Committee for the consideration of one important branch of this inquiry. We shall doubtless hear from my noble friend Lord Wrottesley those recommendations which have been the result of its recent labours, and which will be found to owe much to his enlightened zeal, to his great knowledge and his sound judgment. In the mean time, I trust I may be allowed to make a few general observations on what appear to me to be some of the best means of promoting in this country the advancement of physical science.

It will readily be understood that, in referring for a moment here to the aid which may be afforded by the State to the advancement of science, I divest myself entirely of any official character other than that which belongs to me as your President, and that I seek to give expression to my own opinions only.

I am not one of those who are disposed to look to public authority as the primary or the best supporter of abstract science. In the main it must depend for its advancement on its own inexhaustible attractions,—on the delight which it affords us to study the constitution of the world around us, and to endeavour to understand, though it be but darkly, how the rein of its government are held. Nor am I disposed to indulge in any complaint on a matter which has lately attracted some attention among scientific men. In a great manufacturing country like ours, the disposition of whose people is eminently practical, it is perfectly natural that greater attention should be bestowed on the arts than on the abstract sciences. This, indeed, is but adhering to what has been hitherto, at least, the natural historical order of precedence; for it is a just observation of Prof. Whewell, in his lecture "On the Results of the Great Exhibition of 1851," that practice has generally gone before theory—results have been arrived at, before the laws on which they depend have been defined or understood. Art, in short, has preceded Science. But it is equally important to observe, that in recent times this order has been in numberless instances reversed. Abstract science has gone ahead of the arts, and the conduct of the workshop is now perpetually receiving its direction from the experiments of the laboratory. Perhaps the most wonderful discovery of modern days—that of the Electric Telegraph—was thought out and perfected, so far as its principle was concerned, in the closet and the lecture-

room, and flashed ready-made on the astonishment of the world. In chemistry, the lead taken by abstract science in re-acting on the arts is manifest and constant; and in greater or less degree the same result is appearing in connexion with every branch of physical research. The interest, therefore, of the State, even if it be considered merely in this economic point of view, in the encouragement of abstract science, is obvious and immediate. And there is this additional motive to be remembered: the moment any result of science becomes applicable to the arts, the unfailing enterprise of the commercial and manufacturing classes takes it up and exhausts every resource of capital and of skill in giving to that application the largest possible development. But so long as science is still purely abstract, it has often to be prosecuted with slender resources, and specially requires fostering care and a helping hand. But I rejoice to believe that the conviction of this truth is sensibly gaining ground. The foundation of the geological museums both in England and in Scotland, and the carrying out of a complete geological, concurrently with a geographical Survey, by public authority and at the public expense, were great steps in the right direction. Another such step was the investment of 1,000*l.* annually in aiding experimental research, through the agency of the Royal Society, which undertook the trouble of its special allocation. It is the intention of my noble friend, Lord Palmerston, to bring the principal of some expenditure in this direction specially under the notice of Parliament for the future; and it is worthy of remark, as illustrating how far a small sum may go in aid of abstract science, and how cheaply the largest and most fruitful results may thereby be attained, that, as I have been informed on very high authority, this apparently trivial sum has been felt as a most important help in numberless instances, sometimes in the conduct of experiments, sometimes in the publication of their results, and sometimes in securing accurate artistic delineations.

The relations now established between the Board of Trade and various branches of scientific investigation are such as lay the foundation for further progress in the same direction. I am happy to say that, in connexion with the new National Museum which is being organized for Scotland, there is to be a special branch devoted to the industrial applications of science; and that a new Professorship—one which has long existed in almost all the Continental Universities—that of Technology—has just been instituted by the Government. I am not less happy in being able to announce that to that chair Dr. George Wilson has been appointed. The writings which we owe to the pen of Dr. Wilson, and especially his beautiful Memoirs of Cavendish, and of Dr. Reid, are among the happiest productions of the Literature of Science.

I trust also that the aid of the State may be secured in providing a house and home for the scientific bodies in the metropolis. I am disposed to agree with those who attach no small importance to this consummation. When the Royal Society alone adequately represented all or nearly all who were engaged in physical science, that great body fulfilled all the necessary conditions of a scientific council. But now, when almost every separate division of science has a separate Society of its own, it has become almost indispensable that some new arrangement should be come to, in order that abstract science may have that degree of organization without which its interests will never receive the public attention which they ought to have.

The influence, if not the authority of the State, may also, I think, be most beneficially exerted on behalf of Science, through the educational rules and principles of administration of the Privy Council. But the Committee of Council, in the adoption of those rules, is necessarily governed to a certain extent by the feelings and opinions of the various churches and bodies which are the primary supporters of our existing educational system. In the last Report of the Council of the Geographical Society, they announce a communication from the Committee of the Privy Council, requesting the Society to appoint an Examiner in Geography, to be associated with other examiners on other branches of education. It may be well worthy of consideration, whether the same expedient might not be usefully adopted in reference to other branches of science, which have hitherto formed a less admitted part of ordinary instruction.

And this, Gentlemen, brings me to say, that the Advancement of Science depends, above all things, on securing for it a better and more acknowledged place in the education of the young. There are many signs that the time is coming when our wishes in this respect will be fulfilled. They would be fulfilled, perhaps, still more rapidly, but for the operation of obstructing causes, some of which we should do well to notice. How often do we find it assumed, that those who urge the claims of science are desirous of depreciating some one or more of the older and more sacred branches of education! In respect to elementary schools we are generally opposed, as aiming at the displacement of religious teaching; whilst in respect to the higher schools and colleges, the cudgels are taken up in behalf of classical attainments. A remarkable example of the influence of these feelings will be found in a speech delivered by Lord Lyndhurst during the late session of Parliament. With all the power of his dignified and commanding eloquence, he asserted the right of the elder studies to their time-honoured pre-eminence; and in the keen pursuit of this argument even he was almost tempted to speak in a tone of some depreciation of those noble pursuits in which the University of which he is a distinguished ornament has won no small portion of her fame. But surely no enlightened friend of the natural sciences would seek to challenge this imaginary competition. Perhaps, indeed, like other zealous advocates, we may have sometimes overstrained our language, and have thereby given such vantage-ground to prejudice, that it has been enabled to assume the form of just objection. We cannot too earnestly disclaim the idea that the knowledge of physical laws can ever of itself form the groundwork of any active influence in morals or religion. Any such idea would only betray our ignorance of some of the deepest principles of our nature. But this does not affect the estimate which we may justly put on an early training in the principles of physical research. That estimate may be not the less a high one, because it does not assign to science what belongs to other things.

There is one aspect in which we do not require to plead the cause of science as an element in education, and on that, therefore, I shall not dwell. I mean that in which certain applied sciences are recognized as the essential bases of professional training; as, for example, when the engineer is trained in the principles of mechanics and hydrostatics, or the physician in those of chemistry. Of course, with every new application of the sciences to the arts of life this direct influence will extend. But what we desire, and ought to aim at, is something more. It is, that abstract science, without special reference to its departmental application, should be more recognized as an essential element in every liberal education. We desire this on two grounds mainly: first, that it will contribute more than anything else to the further advancement of science itself; and, secondly, because we believe that it would be an instrument of vital benefit in the culture and strengthening of the mental powers.

But, as regards both of these great objects, we must remember that much will depend on the manner in which elementary instruction in science is conducted; on the conception, in fact, which we entertain of what science really is. Nothing can be easier than so to teach science as to feed every mental vice or weakness which obstructs the progress of knowledge, or blinds men to every evidence of new truths, in self-satisfied contemplation of the few they have already ascertained. May we not illustrate this by the effect which has not seldom been produced by the scientific education of professions? It is true, indeed, that professional men have often enlarged the field of science by the discovery of new and important truths. Some of the strongest-armed pioneers of science have been of this class. But how have their discoveries been too often received by their professional brethren! How many of them have been assailed by every weapon in the extensive armoury of prejudice and bigotry! How many of them have had their name recognized only after it had been written on the grave; and over whom we might well repeat the noble lines—

> ....Now thy brows are cold
> We see thee, what thou art, and know
> Thy likeness to the wise below,
> Thy kindred with the great of old!

What we want in the teaching of the young is, not so much the mere results, as the *methods*, and, above all, the *history* of science. How, and by what steps it has advanced; with what large admixture of error every new truth has been at first surrounded; by what patient watchings and careful reasonings; by what chance suggestions and happy thoughts; by what docility of mind, and faith in the fulness of Nature's meanings; in short, by what kinds of power and virtue, the great men, aye, and the lesser men of science have each contributed their quota to her progress: this is what we ought to teach, if we desire to see education well conducted to the great ends in view. It is not merely for the sake of investing the abstractions of science with something of a living and human interest, that we should recall and revive these passages in her history: nor is it merely to impress her results better on the memory, as we fill up from biographies and other sources of information, the meagre page of the general historian. It is for something more than this. It is both that they may be more encouraged to observe nature, and that they may better understand how to do so with effect. It is that they may cultivate that temper of mind to which she most loves to reveal her secrets. And as regards those whose own opportunities of observation may be small, it is that they may better appreciate the labours of others: and may be enabled to recognize, in the midst, perhaps, of much extravagance, the tokens of real genius, and in the midst of much error the golden sands of truth.

It is one of the many observations of Sir C. Lyell which have a much wider application than that to which they were specially directed, that the mistake of looking too exclusively to the grand results of geological change, and of referring them too readily to sudden agencies of tremendous activity and power, tended to check the advance of that science, by discouraging habits of watchfulness over those operations which are contemporary with ourselves, and the secret of whose power is to be found in the lapse of time. An effect precisely analogous is produced on the progress of science as a whole by a similar method of regarding it. And even when the history of that progress is attended to at all, there is a natural disposition to look back to a few great names among the number of its chief promoters, as beings who, by dint only of some unapproachable superiority of intellect, have taught us all we know. It is true, indeed, there have been a few such men; just as there have been periods of sudden geological operations, which have upheaved at once stupendous and enduring monuments. But even in respect to those great men, it will often be found that at least one great secret of their power has lain in virtues which might be more common than unfortunately they are found to be. That openness and simplicity of mind which is ever ready to entertain a new idea, and not the less willing that it may be suggested by some common and familiar thing, is one of the surest accompaniments of genius. But it is clearly separable from extraordinary intellectual power, although, where both are found together, the great results produced are too often attributed to the more brilliant faculty alone. Prof. Whewell, in his most interesting "History of the Inductive Sciences,' whilst deprecating the degree of attention which has been paid to the well-known story respecting the origin of Newton's thought on gravitation, has nevertheless stated, with his usual clearness and precision, the essential truth which the traditions of science have done well to cherish. Those who have been competent to judge of the calibre of Newton's mind, of its powers of pure abstract reasoning, have with one voice assigned it the highest place in the records of human intellect. Doubtless, it was those powers which enabled him to *prove* what otherwise would have remained conjectured. But it is not the less important to observe, that the suggestion on which these powers were called to work was one eminently characteristic of a mind where simplicity and greatness were indeed synonymous. That the celestial motions, about which so many wonderful facts were then already known, and which had been referred to so many mysterious and imaginary forces, should be indeed identical in kind with the motions which took place close beside him, and that the same rules should be applicable to each, this was an idea in which, to use Dr. Whewell's words, "Newton had no forerunner." We do not need to compare the relative importance of those qualities of mind which are indicated in the first conception of such an idea, and of those other qualities which could alone crown it with demonstration and add it to the number of established truths. For the attainment, by a single individual, of results so grand and so complete as those which were reached by Newton, each was necessary to the other. But characteristics, which were in him united, have not the less had their separate value when divided in other men; and it cannot be too often repeated, that habits of wakeful observation on the commonest phenomena of nature are often alone enough to yield a rich harvest to the man of science, and to crown his labours with an immortal name. This has been a result of continual recurrence in the progress of knowledge. It is the expression and evidence of a truth of equal importance in the moral and the physical world, that the common things which surround us in our daily life, and many of which we do not really see, only because we see them too often and too familiarly, are governed by principles of infinite interest and value, and whose range of application is wide as the universe of God.

And this brings me to say a word on the value of instruction in Physical Science, not merely with a view to its own advancement, but as in itself a means of mental training and an instrument for the highest purposes of education. It is in this latter point of view that its claims seem to be least admitted or understood. We may hear an exception made in favour of the exact sciences, which involve the application of mathematical knowledge, since this has been long recognized as requiring the highest intellectual exertion; but with regard to other sciences, how often do we hear them condemned as afford-

ing "mere information," and as tending in no sensible degree to strengthen and invigorate the mental powers! But, again I say, this would entirely depend on how science is to be taught —whether by a mere cramming of facts from manuals, or by explaining how and by whom former problems have been solved,—what and how vast are other problems yet waiting for, and capable of solution. And even where the researches of physical science can do little more than guide conjecture, or illustrate merely what it cannot prove, how grand are the questions which it excites us to ask, and on which it enables us to gather some amount of evidence! In Geology, is it true, or is it not true, that, "we can see no trace of a beginning—no symptom of an end?" To what extent, and in what sense are we yet entitled to say, that there has been an advance in organisation as there has been advance in time? In Physiology, what is the meaning of that great law, of adherence to type and pattern, standing behind as it were, and in reserve of that other law by which organic structures are specially adapted to special modes of life? What is the relation between these two laws? and can any light be cast upon it, derived from the history of extinct forms, or from the conditions to which we find that existing forms are subject? In Vegetable Physiology do the same, or similar laws prevail,—or can we trace others, such as those on the relations between structure, form and colour, of which clear indications have already been established, in communications lately made to this Association by Dr. M'Cosh and Dr. Dickie of Belfast? In Chemistry, how is it that some of the most powerful actions escape our finest analysis? In Medicine, what is the action of specifics? and are there no more discoveries to be made such as rewarded the observation of Jenner, in the almost total extinction of a fearful and frequent scourge? It is in reference to such great questions, and ten thousand others equally interesting and important, that the pursuits of science call forth the highest activities of the mind and exercise every power of thought and reasoning with which it has been endowed.

Indeed, it may fairly be questioned whether those sciences which are called exact, are necessarily the best preparation for the actual business of the world. It is the rare exception, and not the rule, when exact and perfect demonstration becomes applicable to the affairs of life. In general, men have to balance between a thousand probabilities, and to take into account a thousand conflicting tendencies. Surely there can be no training better than that which teaches us by what careful inductive reasoning—by what separation between permanent and accidental causes—by what constant reference from the present to the past, and from the past back again to the present, our existing knowledge has been attained in the paths of physical research. It is true, indeed, that where men's passions and prejudices are much concerned, no amount of teaching will ever induce them to follow or attend to the best methods of arriving at the truth. But even where there are no such disturbing causes, where moderate and candid men are expressing their sincere convictions, how constantly do we hear them ascribing effects to causes, which the slightest habit of correct reasoning would have been sufficient to dismiss! In questions of great social or political, as well as of philosophical importance, the want of such habit is often most painfully apparent, and serves in no small degree to retard the progress of mankind. The necessity of considering all questions with reference to fundamental principles, or laws, and these again with reference to the disturbing causes which delay or suspend their operation, the mode of weighing evidence, and the degree of value to be attached to that which is of a merely negative kind—these are things of which we are perpetually reminded in the pursuits of science; and these surely are no useless lessons, whether in religious, social, or political affairs.

And then there is another consideration of no small importance. As Science has now come to a stage in her progress, when she heads the Arts, and flings back upon them her reflected light, so also has she now reached a degree of development which casts some rays forward on questions of higher import than those which she can fully answer. It is in vain that we try to draw definite lines between the physical and the metaphysical—between the secular and the religious. There is a felt relation between the laws which obtain in each—such, indeed, as we might expect to find in provinces of a universal empire. The consequence is, that in every speculation on those higher questions on which men will and must speculate—in every system of Philosophy, whether ancient or modern, they draw not merely their illustrations, but not a few of their conclusions from science, or from that which passes by the name. If, therefore, her discoveries, and above all, her methods and her history, be but partially and superficially understood, the popular mind will be a perpetual prey to the most specious forms of error. But that history teaches caution. It is full of warning as well as of example. In being a history of the progress of knowledge, it is a history also of the obstructions which knowledge has encountered, and an index of those to which she is still exposed. The influence of opinions and theories preconceived—of rash conclusions, and of false analogies, has been, and still is, a perpetual source of danger. So much is this the case, that we soon learn to receive with extreme caution the inferences drawn by men of science from the facts they may bring to light, wherever these inferencs touch upon other departments of knowledge. The relation in which a new fact or law stands to others is seldom at once rightly understood. It is only through fightings and controversies of every kind that it gradually finds its place; and becomes, not unfrequently, an instrument in defence of truths which at first it was supposed to sap and undermine. I do not mean to say that the full meaning of the discoveries of science is always brought to light. Far from it. It would be more true to say that their ultimate meaning is never reached; and that for every question which Science answers, she propounds another which it is beyond her powers to solve. But in this we may see the strongest of all arguments against our entertaining any fear of Science as regards the interests of Religion. It is sometimes proudly asked, who shall set bounds to Science, or to the widening circle of her horizon? But why should we try to do so, when it is enough to observe that that horizon, however it may be enlarged, is an horizon still—a circle beyond which, however wide it be, there shine, like fixed stars without a parallax, eternal problems in which the march of science never shows any change of place. If there be one fact of which science reminds us more perpetually than another, it is that we have faculties impelling us to ask questions which we have no powers enabling us to answer. What better lesson of humility than this—what better indication of the reasonableness of looking to a state in which this discrepancy shall be done away—when we shall "know, even as we are known!"

But, gentlemen, I have already detained you too long, and occupied your time far less profitably than it would have been occupied by many who are present on this occasion. The hospitality of this great city will afford you, I trust, a pleasant, and your own exertions will secure a profitable meeting. You may well engage in its business and discussions, with a sense

of the high interest and value of your pursuits—not less interesting in themselves—not less conducive to the progress and happiness of mankind—not less tasking the noblest faculties of the mind, than those which engross the attention of jurists, of soldiers, or of statesmen, when their motives are the purest, and their objects are the best.

Coleoptera collected in Canada.*

By WILLIAM COUPER, Toronto.

For Authorities and Synonyms, see Melsheimer's Catalogue.

AUCHOMENUS

EXTENSICOLLIS Say; *Lecontei* Dej.

Palpi 4; pair beneath the mouth 2-articulate: second pair longer, 3-articulate; antennæ, 10-articulate; thick and smooth at base; 9th to apex slightly villous; head of a greenish color, and polished, rather rhomboid in form; thorax of a greenish color, polished, with a longitudinal sulcus through the disc, the margin narrow and more elevated posteriorly; elytra slightly tinged with purple, polished, striate, 8 striæ on each elytron—from the posterior region of scutellum abbreviated striæ occupies each side of the suture; body beneath black; femoræ, tibiæ, and tarsi yellowish-red. Toronto, common. Length 4½ lines.

Taken in lat. 54°.—*Kirby*.

ANISODACTYLUS

(?) ELLIPTICUS LeConte; Pr. Acad. N.S.

Black. Jaws strong, and, when constricted, are covered by a lamellate organ; palpi 4: 2-articulate, length equal; antennæ reddish, 10-articulate, the basal articulation thickest and longest: second shortest, and the apex obtuse; head wider than long, the eyes very prominent, with a transverse cavity on top and in a line with the base of the antennæ; thorax with an obscurely longitudinal line through the disc, margined, smooth anteriorly, the angle in a line with the eyes: depressed, granulate without polish posteriorly; elytra margined, striate, 8 distinct striæ on each elytron; femoræ, tibiæ, and tarsi reddish-yellow: the posterior tibiæ densely toothed. Toronto, common. Length 7 lines.

OCHTHEDROMUS

TRANSVERSALIS Dej.

Palpi 4: pair beneath the mouth 2-articulate, the apex pointed—second pair 3-articulate, longer, and pointed at the apex; antennæ 11-articulate, slightly villous; head and thorax black, polished, the latter narrow posteriorly; elytra striate, punctured in the striæ, the latter rather obsolete towards the margin; one yellow spot behind each shoulder, and another occupy the margin on each side near the apex; body beneath black; femoræ, tibiæ, and tarsi yellowish. Toronto, common. Length 2¼ lines.

COPRIS

AMMON Fabr.; *minutus* Drury.

♀. Entirely black; clypeus rounded in front, extending on each side beyond the eyes, having a slight protuberance on top; thorax margined, rather prominent, with densely minute punctures; scutellum obsolete; elytra furrowed, longer than the thorax, and margined; femoræ strong; tibiæ small at the base, thickened towards the tips, and armed with spines. Toronto, not common. Length 4½ lines.

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* See pages 210, 256, and 324 of this *Journal*.

THANEROCLERUS

SANGUINEUS Say; *Mels. Cat.* p. 83.

Antennæ 11-articulate, thicker at the apex; head dark purple, finely punctured, and interspersed with short hairs, truncate in front; thorax narrower behind than the elytra, and of a dark purple colour, also interspersed with short hairs; the punctures are more distinct than on the head; elytra blood-red, densely punctured, and covered with short stiff hairs; body beneath and legs reddish. Toronto, under the bark of trees; not common. Length 2 lines.

CONOTRACHELUS

Closely allied to *C. nenuphar*, Hbst.

General color rusty red; proboscis curved, the sides margined about half its length from the base, and wider at the apex, which is black; antennæ elbowed, placed about the middle of proboscis; eyes black; head short, and narrower than the thorax—the latter is granulate, and through the centre of which runs an abbreviated, polished, elevated line, with a raised polished dot on each side: narrower than the elytra; the elytra are densely punctured, and ridged with polished protuberances in front, and a broad fascia of white silky hairs, on which the punctures are rather obsolete—behind which a protuberance occurs on each elytron near the apex; femoræ clavate—posterior pair toothed. Length 2¼ lines.

This weevil destroys the butternut (*Juglans cinerea*). About the middle of August, the diseased nuts may be found beneath the trees growing on the Don flats. They are generally punctured in the side, and each contains one or two *larvæ*. I have not ascertained the time in which the *ova* are deposited, but for the purpose of discovering the *imago*, I selected about twenty of the diseased nuts, which were placed in a situation suitable for their metamorphosis. In a short time the nuts turned black, resembling an earthy substance, and in this state I examined the *larvæ* more closely; only two had become *pupa* and formed cocoons, the remainder (about twenty-four) were attacked by a Dipterous parasite, and destroyed. The two specimens obtained appeared in the *imago* state on the 27th of August.

TRAGOSOMA

HARRISII Lec. J. Acad. 2d, 2, 107.

Antennæ 10-articulate, the basal articulation short and thick: 2d longer, and knobbed near its connection with the 1st; head short, inclining down, the eyes almost connect on top; thorax broader than long, and much narrower than the elytra—rather rugose from the number of punctures, with a short spine on each side; scutellum bell-shaped; elytra long, covered with close impressions and very fine longitudinal elevations; breast downy; color dark chestnut. Toronto, very rare. Length 1 inch, 1 line.

My specimen was found dead in July last on the Island opposite Toronto. It evidently had been sometime in the water, which destroyed much of its natural color and freshness.

CALLIDIUM

VIOLACEUM Linn. Harr. Ins.

Of a beautiful blue or violet color; thorax transversely oval; elytra irregularly punctured. Varies in length from 4-10ths to 6-10ths of an inch, and may be found from the middle of May to June. It is very fond of pine.

I have not met a living specimen in the vicinity of Toronto. The only Canadian specimen in my collection is without the head; it was given to me by Mr. Ibbetson, who says it is rare. My description is from Mr. Harris.

CLYTUS

UNDULATUS Say; *undatus* Kirby. *Sayi* Lap. teste Hald.

Antennæ 10-articulate: a white spot at the base of each; head black, short and truncate in front; thorax globular, of a soot color, finely granulate on top, with a ring of whitish hairs on the margin in front, and slightly cinereous on each side posteriorly; elytra covered with short hairs of a lighter color than thorax, and marked as follows:—About one line behind each shoulder angle, a white spot forms an arch, and from the region of scutellum a white line occupies the suture, connecting with an oblique branch which crosses from the lateral margin, and from the latter oblique branch two longitudinal lines point posteriorly—the outside line joins the margin, the inside one joins the sutural line, enclosing a square spot of the ground color on each side of the suture: the apex is spread apart and margined with white; anterior legs short, posterior pair long; body ringed with white. Toronto and Owen Sound, not common. Length 7½ lines.

Taken by Sir John Richardson on the shores of the Arctic Sea, mouth of the Mackenzie river.

FLEXUOSUS Fabr.; *angulatum* Fabr.; *picta* Drury; Harris's Insects, p. 85; *robinæ* Forst.; *ziczac* Voet.

Velvet black; three transverse yellow bands on the head, four on the thorax, and six on the elytra—the tips of which are also edged with yellow; the 1st and 2d bands on elytra are almost straight, 3rd band forms a V, or, united with the opposite one, a W, as in *speciosus*—the 4th angled, and runs upwards on the inner margin towards the scutel, the 5th is broken or interrupted by a longitudinal elevated line, and the 6th is arched, and consists of three little spots; antennæ dark brown; legs rust-red. Varies from 6-10ths to 3-4ths of an inch in length. In September on locust trees, flowers of golden rod, and other flowers.—*Harris*.

In September last, I witnessed in a garden in Montreal, in which grew the species of locust attacked by these beautiful beetles—their singular attachment and propensity to destroy the above mentioned ornamental trees—an account of which is truthfully given by Mr. Harris in his Insects Injurious to Vegetation.

LEPTURA

8-NOTATA Say.

Palpi 4; antennæ 10-articulate; head black, wider than thorax—the latter black, polished, narrower anteriorly than posteriorly, much narrower than elytra, and interspersed with yellow hairs; elytra black, polished, densely punctured and covered with yellow hairs: four yellow spots on each elytron, and wider across the shoulders than at the apex—the latter spread apart; anterior femoræ and tibiæ black, tarsi with brush-like appendages; upper section of posterior femoræ yellow, posterior tibiæ black, and the tarsi yellow; body beneath, black, polished. Toronto, on wild parsnip; not common. Length 4½ lin.

MELANDRYA

STRIATA Say; *thoracica* Mels. Pr. Acad. (var. *a*); *bicolor* Mels. Pr. Acad. (var. *b*).

Palpi moniliform, 3-articulate, 2nd articulation shortest; antennæ 11-articulate, the 2nd basal articulation shortest; head, in the centre, as broad as long; thorax almost deltoid in form: finely punctured, with three hollows on top—the central one longitudinal, the marginal ones abbreviated; scutellum smooth rounded posteriorly; elytra striate, eight punctured striæ on each elytron. Length 6 lines. Toronto, common. They are generally found in decayed wood.

The color of the above is black. Specimens were sent to me from the north-western part of the Province, which are of a dull chestnut color, with red thorax; they may be the varieties cited in Melsheimer's Catalogue.

The Laying of the Foundation-Stone of the Hall of the Canadian Institute.

On Tuesday, November 14th, His Excellency the Governor-General laid the foundation-stone of the Hall of the Institute, about to be erected on the handsome and extensive building site on Pembroke Street, presented by G. W. Allan, Esq. The ceremony took place at three o'clock in the afternoon, under most favourable and auspicious circumstances. A guard of honour, of the Enrolled Pensioners, was in attendance with their band. The members of the Institute assembled in Moss Park, whence they marched in procession to the building site, to receive His Excellency the Governor-General. His Excellency the Governor-General was attended by the Hon. Inspector-General Cayley, and Aides-de-camp Colonel Irvine and Captain Retallack. He was received with the usual military salutes, and was conducted by the Council of the Institute to a platform prepared for the purpose. Surrounding the platform on which His Excellency stood, elevated galleries were erected, one on the north for ladies, one on the west for members of the Institute, and one on the south for the Public—all of which were well filled. The ceremonies were commenced by the President of the Institute reading the following Address:—

To his Excellency Sir Edmund Walker Head, Baronet, Governor General of British North America, &c. &c. &c.

MAY IT PLEASE YOUR EXCELLENCY:—

We, the President, Council and Members of the Canadian Institute of Upper Canada, beg leave to renew the assurances of our devoted loyalty to Her Majesty, and to express to your Excellency the high gratification with which we see in the representative of our gracious Sovereign, one who, by the distinction achieved by him as member of the most ancient University in the empire, has given the best evidence of his personal interest in the cause of learning.

Permit us on this the first occasion of our unitedly addressing your Excellency, most respectfully to offer to you our cordial welcome to the capital of Upper Canada, and to express to you the satisfaction with which we are animated by the assurance, that, while your wisdom and experience will guide you in those responsible administrative duties which lie beyond the sphere of our objects, your distinguished academical career furnishes guarantee for your generous sympathy and encouragement in all that relates to the progress of those objects for the promotion of which we are associated together.

The Canadian Institute, founded in the year 1849, and incorporated by Imperial charter in 1851, has been established for the encouragement of learning and the developement of

science and the arts throughout this province. Originally instituted by a small body of gentlemen united for the purpose of promoting one special branch of practical science, it has since extended its aim so as to embrace the widest range of a scientific and literary society, and now numbers upwards of four hundred members, resident in all parts of the Province. The steps adopted for carrying out these comprehensive objects have been :—

Firstly. The formation of a Library of Scientific Reference, available to the public at large, and which, now that an amalgamation has been effected with the Toronto Athenæum, and the books of both institutions have been united, already constitutes the nucleus of a Library from which valuable results may be anticipated.

Secondly. The establishment of a Museum, with a special view to the illustration of the Natural History and Mineral Products, and the Economic and Industrial Resources of the Province, as well as the Ethnological and Archæological contributions to history which specially pertain to this important section of the new world.

Thirdly. The reading of original, scientific and literary communications, and discussion of the subjects thus introduced at weekly meetings held in Toronto during the winter session. And,

Fourthly. The publication of a Monthly Journal, which has now been in successful operation for more than three years, and forms not only a report of the proceedings of the Institute and of other scientific bodies in the province, but is designed to embody a record of the intellectual and economic progress of Canada, as well as to furnish an abstract of scientific proceedings throughout the world.

In accomplishing these objects the Institute has greatly to acknowledge the liberal encouragement of the Government by means both of an annual grant of money and by free accommodation furnished for a time in the Government House. The withdrawal of the latter, consequent on the transference of the Seat of Government to Toronto, added to the requisite increase of space rendered indispensable for completing the scheme of establishing a Provincial Scientific Library and Museum, have mainly contributed to force upon us the necessity of providing adequate and becoming accommodation in a building of our own. In furtherance of this we have to acknowledge the gratifying recognition of the public benefits already resulting from this Institute, in the important aid extended to us by the Provincial Government for this special object, in addition to the liberality of many of our own members, and especially the valuable gift of this site, presented to the Institute by George W. Allan, Esq., and now to be dedicated with your Excellency's gracious aid to the cause of Canadian science and scholarship.

Animated by the assurance of your Excellency's cordial sympathy in such a cause, we hail your presence among us this day as an evidence of your approbation of the objects aimed at in our union as members of the Institute, and of your appreciation of the value of such institutions for promoting the diffusion of knowledge and the advancement of science and sound learning, on which the true glory of this great Empire is founded, and by which the future greatness of this Province must be advanced.

Permit us, then, to crave of your Excellency on this auspicious occasion, when we are assembled to found a building to be devoted exclusively to the peaceful objects of intellectual emulation, that you will be graciously pleased to commence the work for us by laying the first stone.

His Excellency read the following reply :—

Mr. President and Gentlemen of the Canadian Institute,—

If my presence here this day can benefit the Institution to which you belong, I feel that you have a double claim upon me.

Indirectly I have been the means of turning you out of house and home : the least I can do is to help in inaugurating your new dwelling. But the intrinsic usefulness of a society such as yours, is the strongest reason why I would do my best to promote its interests.

The means which you have adopted for diffusing a taste for Science and Literature, seem well calculated for attaining heir end.

Your Museum, your Lectures, and your Journal, all tend to produce those feelings which are essential to progress in knowledge of all kinds. They encourage the conviction that every fragment of information, and every scrap of knowledge is valuable, without reference to its immediate practical utility. A fact established is so much gained towards the sum total of human knowledge, and no man can say in what train of reasoning that fact may hereafter prove a stepping stone.

The stores of your library will serve to supply the refinement of taste, and the cultivation of the intellect, which enables one man to impart knowledge to another in its most attractive form, which make the act itself of learning, a relaxation and a pleasure.

I receive with the utmost satisfaction the assurance of your loyalty to our gracious Queen.

As regards myself personally, your Address is far too flattering in every way; but I thank you for your welcome to Toronto, and I trust that my readiness to lay the first stone of this building will be taken as a mark of my desire to promote on all occasions the interests of the Canadian Institute.

G. W. Allan, Esq., then advanced and said :—

Mr. President, and gentlemen of the Canadian Institute,—I have much pleasure in presenting you with a deed of the site, on which your building is to be erected. In doing so permit me to express my gratification to have it in my power to promote in any way the objects of an Institution in whose welfare I feel so deep an interest. Having been connected with it from its

commencement, I have watched its progress to its present state of prosperity, and I look forward with no small degree of pride as a Canadian to the arrival of that day when this body will be entitled to take rank among similar bodies in any part of the world. I trust that this day's proceedings will give a fresh stimulus to the Society; and when I recollect the different scene presented here, not many years ago, when the most sanguine would not have anticipated that ground, then covered with forest, would now be the site of a building dedicated to the advancement of science, I am happy to have been in any way instrumental in providing a permanent site for an Institution, whose name, I trust, will ere long be favorably known far beyond the precincts of Canada.

The President of the Institute replied :—

Mr. Allan,—The Canadian Institute accepts with grateful acknowledgement your very liberal gift; and I feel that I could scarcely express too strongly the sense entertained by the Council and Members of the Institute of the obligation which you have conferred upon them.

They are well aware of the pecuniary value of the donation, for they are not ignorant of the large prices which in this prosperous city can be readily obtained for land less eligibly situated; and I need not tell you how materially the value has been enhanced by the grant coming so opportunely at the moment when the patronage of the Legislature has enabled the Institute to proceed in the erection of a building, and when the means were wanting for procuring a proper site on which to place it. This they now possess through your kindness; and the Canadian Institute and its friends will seldom look upon the handsome and commodious structure by which they intend this ground shall be adorned, without recollecting how much they are indebted for it to your respect for science and to your known disposition to co-operate heartily and generously in any measure by which the character of your countrymen may be elevated, and their rational enjoyment promoted.

The Rev. H. J. Grasett, Rector of St. James's, then offered the following prayer, during which solemn service every head was uncovered :—

O Almighty God, Father and Creator of all; Thou who by wisdom didst make the heavens and lay the strong foundations of the earth, we bow before Thee and humbly offer up our prayers and supplications for a blessing on our present undertaking.

In all our works we depend on thy protection and power. Enable us to begin, continue and end them all in Thee; for, O Lord, there is no wisdom like thy wisdom, no power like thy power, and therefore no dependence secure from disappointment, but that of making Thee our trust.

Make us always mindful that in the important purposes for which we are here associated, we have constant need of that illumination to guide us, which cometh down from above. And do Thou so bless our endeavors that those who shall here pursue the study of thy laws and of thy works, may be impressed with a due sense of the motives from which they should act, and the ends which they ought to seek in the whole course of their life. Thus may they pass their days and pursue their investigations with comfort and satisfaction to themselves, and through thy mercy in Christ Jesus, enter into thy eternal rest when the hour of their departure shall arrive.

We pray Thee to sanctify the pursuits of this Institute and of every kindred Society, and cause them to redound to thy glory and to the good of mankind. O let not infidelity be suffered to extend its deadly influence among men. And do Thou not only preserve the profession of Christianity in the world, but pour forth the Grace of thy Holy Spirit on all who believe in its truth, that they may show forth a greater zeal in its cause and adorn it by a more holy example.

Grant that the days of peace may return, and with them abundance of grace. Let the light of thy Holy Word and the blessings of civilisation resulting therefrom spread abroad in all lands. O hasten on and delay not the day, when all from the least to the greatest shall have a true knowledge of Thee and thy ways—when men shall beat their swords into plowshares, and their spears into pruning hooks, when nation shall not lift up sword against nation, nor learn war any more. But if it be not yet thy will to put an end to the distress of nations, wa earnestly pray Thee to show mercy to afflicted individuals, by making the sufferings which they have to endure in this life the means of their looking for that blessed hope, and the glorious appearing of our Saviour Jesus Christ.

Make us all sensible of what we owe to Thee, for our quietness at home; for the uninterrupted administration of the means of grace: and for the blessings of civil and religious liberty which we so abundantly enjoy. Give us grace to make such a diligent use of these blessings, as to be daily improving in faith, holiness, charity, and all other christian virtues; that whatever be the events which in thy righteous providence Thou mayest permit to take place in the world, or however they may affect us in our temporal circumstances, our souls may hereafter be received into thy heavenly kingdom.

These mercies we ask in the name of Our Lord and Saviour Jesus Christ: through whose mediation we hope for them, and to whom, with thyself, O Father, and the Holy Ghost, be glory for ever and ever. Amen.

A handsome silver trowel was then presented by the architect, Fred. W. Cumberland, Esq., to his Excellency, who proceeded to perform the ceremony of laying the foundation stone. Beneath the stone in a cavity prepared for the purpose were deposited the Royal Charter of the Institute, a list of its Officers, a copy of the Address presented to his Excellency, and a copy of the 1st number of the Canadian Journal.

The ceremony being completed, the President addressed the Governor General, as follows :—

May it please your Excellency :—

Though the Society whose home is to be upon this spot, —through many years, as we hope, of increasing usefulness,—is but of recent origin, its members form already a numerous body, and are widely dispersed over the province. It will give great pleasure to those of them who are absent, to learn, as it has to those who on this occasion are present, to witness the auspicious commencement of our projected building. And they will all be grateful to your Excellency for the part which you have condescended to take in this proceeding.

The efforts of the Canadian Institute to accomplish the objects for which it was organized, must for a time be feeble; and to speak of the benefits which we trust it may be the means of conferring, it becomes us to express our hopes rather than our conviction.

Yet the country which is to be the field of its operations is seen by your Excellency to be one of great promise, and if it shall please the same good Providence which has given to us in such abundant measure the elements of material prosperity, to bless us with the continuance of peace, and to maintain among our people the same respect for law and order which has hitherto honorably distinguished them, it cannot be unreasonable to expect that some among the natives of Canada will become eminent in the walks of science, and obtain a celebrity which will shed lustre on the country of their birth.

The Government and the Legislature of the Province, which have made such strenuous efforts for the diffusion of elementary instruction among all classes of the people, have done much to encourage the Canadian Institute in the early stage of its progress, and we have no reason to doubt that they will extend to it their continued countenance and support.

The Governor General replied—Mr. President: Before quitting this spot, I must express my perfect concurrence in those hopes to which you have just given expression. I see every reason to hope that the future of Canada may make her as distinguished in literature and science as she is at present in material prosperity. I find additional reason to hope this when I see that a single individual, Mr. Allan, has shown so much zeal and liberality in the cause by his gift on the present occasion. It gives me double pleasure to assist in the ceremony of laying the foundation-stone of the Canadian Institute, when so noble a donation has been made by one of its members.

The proceedings were closed with hearty cheers for His Excellency the Governor-General, who, with his suite, drove from the ground while the band was playing the National Anthem.

THE CONVERSAZIONE.

On the evening of the same day (Tuesday, Nov. 13th), the members of the Institute assembled, by invitation, at Moss Park, the residence of G. W. Allan, Esq., Vice-President. His Excellency the Governor-General was present, together with a number of distinguished members of the present Government. Refreshments were abundantly supplied to a very large number of visitors; and various rooms on the first floor of the mansion were severally devoted to the exhibition of works of Art, Natural History, and rare Microscopic preparations. Two papers were read, one by Professor Wilson, of University College, on "Some Associations of the Canadian and English Maple;" and the other by Paul Kane, Esq., entitled, "Notes of a Trip to Lord Selkirk's Settlement on Red River, Hudson Bay Company's Territory." Mr. Kane exhibited various sketches in oil of many attractive scenes in North-Western life. Professor Wilson's paper we give at length below:—

SOME ASSOCIATIONS OF THE CANADIAN AND ENGLISH MAPLE.

By Daniel Wilson, LL.D., *Professor of History, University College, Toronto.*

On this auspicious occasion, when the members of the Canadian Institute assemble together under such unwonted circumstances of social intercourse, it may, perhaps, be thought pardonable to select a subject which admits of treatment more in the recalling of some ancestral festive associations, than in any new contribution to the scientific or literary acquisitions which are presumed to constitute the attractions of our ordinary meetings. With this object, therefore, our Canadian Maple and its English congener have been selected, as a theme associating some pleasant ideas of the old world with those of the new.

The ancient virtues ascribed to the English Maple appear to have been derived by our ancestors from that hardy race of Northmen, by whom it is no longer doubted that this continent was visited, centuries before the adventurous barque of Columbus touched the shores of the new world. The Ante-Columbian discovery of Vinland by the Scandinavian voyagers of the tenth century, and the recognition of that long lost land as part of this continent, have naturally induced the American Archæologist to turn with curious interest to anything which may seem to indicate the faintest trace of Scandinavian influence in the monumental arts, or in the traditions of the country. In some cases, indeed, as in that of the inscribed Deighton rock, it can scarcely be doubted that the too-credulous antiquary of the new world has made the wish father to the supposed discovery.

On first arriving in Canada, and learning of the adoption, apparently by universal consent, of the leaf of the *Acer Eriocarpon*, or White Maple, as one of the emblems of Canada, I was prepared to learn of some traditions or superstitious legends connected with this tree, which, while they gave an Indian origin to its native associations, might also possibly indicate some faint trace of the traditional links which are occasionally found to connect widely severed races of the human family. This hope, it would seem, is falacious; but the following genuine Indian legend which I noted down from the recital of an American missionary among the Chippawas of Lake Superior, is interesting, as furnishing an indication that the gorgeous crimson hues of the American Maple do occasionally attract the attention of the wild Indian:—

The Chippawas believe that the mother of their tribe was a woman whom a great Manito made out of a tree which grew by the banks of the river. She had three sons at a birth, the first of whom became a beaver, and built his lodge by the river; the second changed into a fish, and swimming swiftly down the stream, disappeared in the great lake; but the third, when he grew up, became the father of the Chippawas. He went off at a certain time to hunt, and the Great Spirit met him and gave him a bow and arrows, telling him to shoot the first living thing he came to, and he would never want food thereafter. The Indian wandered many days, and at length returned toward his lodge, but he had seen no living thing. His mother came out to meet him, and he told her what the Great Spirit had said to him, and of his wandering many days in vain. Thereupon she told him he had not fulfilled the commands of the Great Spirit, and turning about, she fled swiftly away. Then he remembered that this was the first living thing he had seen, and drawing his bow he pierced her with an arrow as she fled, and she immediately turned into a maple tree; but its leaves were blood-red, as they still are

when the season returns, and wherever a drop fell from them the wild rasp grew up on the spot. But hastening on, he drew his arrow from the tree, and immediately there flowed out the sweet maple juice, and the Indian drank of it and was refreshed, and he gave of it to his brother, the beaver, and they knew that it was the Great Spirit who made the mother of the Chippawas.

Such is a legend of the Indian tribe to which this land once pertained, showing, as might have been expected, that the substantial products of the *Acer Saccharinum*, rather than any graceful beauties in other varieties, constitute their source of estimation of the maple tree.

Without supposing that there is the slightest grounds for tracing a common origin, it will be seen that the idea of men being originally made from trees, was as favourite a legend among our Anglo-Saxon ancestors as with the Indians of Lake Superior; and familiar as all of us now are with the new emblematic significance attached to the beautiful Canadian Maple Leaf, figured on the silver trowel with which his Excellency laid the foundation stone of our new hall this day, it may not be uninteresting to recall some of the associations which centuries have gathered around the common maple of England, as well as other species of the tree to which the Romans gave the generic name of *Acer*.

This name would appear to have been applied in various forms in several of the Indo-European languages, to trees not always of the same genus, nor even bearing a very close resemblance to each other. It is the *Aser* and the *Ask*, of the old Norse eddas, as in the Edda Saemundi, where the *Aser Ygdrasils*, or tree of Odin is referred to: the mighty tree under which the Gods of the Norsemen were believed to sit in judgment, while its branches extended throughout the world, and overshadowed heaven itself. It is also the *æsc* of the Anglo-Saxons, which, in the language of our forefathers, not only signified the ash tree, but also *a man*, because the northern nations supposed the first man to have been made of that tree. It is the *masarn* of the ancient Britons, still applied by the Welsh to the sycamore tree; and the German *maser*, the Dutch *maeser*, the old Swedish *masur*, the Icelandic *mausur* and *mosor*, and the Scottish and old English *mazer*, as well as the modern English maple, all applied to the varieties of the maple tree. From the various forms of the name it appears to be obvious that the old English one is derived from a Scandanavian and not an Anglo-Saxon source; and a similar origin has been assigned to the well-known superstitious virtues ascribed to the Scottish Rowan, or Mountain Ash, as at once a potent instrument of witchcraft, and an infallible charm against its spells. To a like source it would also seem no less probable that we may trace that ancient application of the maple, to which I have now specially to refer, for the manufacture of the favourite drinking-cup and wassail bowl. The close texture of the maple wood, with the beauty of its grain, and its susceptibility of a high polish, doubtless contributed to its continued use for the manufacture of the pledge-cup and bowl. Hence its Scandinavian name of maser came to be applied to the cup made from the wood of the tree; and when at a later period, other woods, and even the costliest metals were substituted, the old designation of the mazer-cup was still retained. The late Mr. T. H. Turner, remarks, in a series of papers in the *Archæological Journal*, on the "usages of domestic life in the middle ages:" "our ancestors seem to have been greatly attached to their mazers, and to have incurred much cost in enriching them. Quaint legends, in English or Latin, monitory of peace and good-fellowship, were often embossed on the metal rim and on the cover; or the popular, but mystic Saint Christopher, engraved on the bottom of the interior, rose in all his giant proportions, before the eyes of the wassailer, giving comfortable assurance that on that festive day, at least, no mortal harm could befall them."

The value attached to the mazer-cup in olden times, no doubt, arose in part from the veneration with which it came to be regarded as a family heirloom, and as such, engraven with favourite devices and pious legends, and sometimes decorated with chasing and rich carvings. That it was held in special esteem, independent of its mere intrinsic value, is shown by its frequent specification in old inventories and valuations. In an assessment of the Borough of Colchester, for example, in the beginning of the 14th century, (29th of Edward I.) mazers are repeatedly mentioned among the household effects of the citizens, and always at valuations which show them to have been wooden bowls. One *ciphus de mazero* is valued at 18*d*., and another *ciphus de mazero parvus* at 6*d*. The highest valuation of a citizen's mazer-cup is 2*s*., and this may, perhaps be assumed to have had the addition of a silver rim, decorated with legend or moral rhyme. A deeper historic interest attaches to the more costly mazers mentioned in an inventory of the treasure and jewels of James III. of Scotland, as the "Four Masaris called King Robert the Brocis." But very different, yet not perhaps less curiously illustrative, is the following inventory introduced in the old black-letter ballad printed by Wynken de Worde, entitled, "*A lytell geste of Robyn Hode.*" The goods are those of the Sheriff of Nottingham, and the inventory is by "Lytell John":—

> "They dyde them to the treasure-house
> As fast as they might gone,
> The locks that were of good stele
> They brake them every one;
> They took away the sylver vessels
> And all that they might get,
> Peces, mazers, and spones,
> Wolde they none forgete."

The quaint simplicity both of the decorations and the inscriptions of many of those old wassail bowls furnishes interesting illustrations of the manners and ideas of the age to which they belong. Our forefathers had a pious, and, withal, a very convenient fashion, of uniting religion with their daily sports, and even as it might seem, seeking to sanctify their excesses. Chaucer and Dunbar wind up their freest versions of the Decameron with a pious couplet; and the latter poet thus closes his "Droichis (or dwarf's) part of the play"—

> "God bless thame, and the haly rude,
> Gives me drink, sa it be gude;
> And wha trowis best that I do hide,
> Skynk first to me the can."

A very beautiful mazer of the time of Richard II., now in the possession of Evelyn Philip Shirley, Esq., is made of highly polished maple wood, hooped with a richly ornamented rim of silver gilt, on which is engraven the couplet:—

> "In the name of the Trinitie,
> Fill the kup and drinke to me."

Inscriptions of this nature were doubtless regarded as nearly equivalent to the more modern grace, and they are accordingly of frequent occurrence, as on the beautiful Hebridean Drinking Cup, celebrated by Sir Walter Scott, in the "Lord of the Isles," as that—

> "Erst own'd by Royal Somerled."

It is also of a smooth polished wood, probably maple, and

on its silver rim is the date 1493, and this appropriate verse from the CXLIV. Psalm, according to the Vulgate: "*Occuli omnium in te sperant Domine, et tu das escam illorum in tempore opportuno.*"

A few of the notices of the mazer by our earlier poets will suffice to illustrate the familiar use of the maple-bowl in ancient times. The earliest mention of it which has come under my notice occurs in an English metrical version of "Wace's Brut d' Angleterre," executed by Robert Mannying, or Robert de Brunne, in the reign of Edward III. Maister Wace's *De Brut*," which he finished in the year 1155, is a French metrical version of Geoffrey of Monmouth's History of Britain, from the time of the imaginary Brutus to the reign of Cadwallader, A.D. 689. As a historic document it is, of course, valueless; but, like most of the old romances, it furnishes valuable illustrations of the manners and customs of the age in which it was written. The passage referred to occurs in the account of King Arthur's coronation. The ceremony, with all its feastings and jousts, being over, the King dismisses his guests with suitable gifts. To Knights and Nobles he gives burghs and cities; to Abbots and Bishops, rents and tithes; and to those—

"That of other landes were,
That for love came there,
He gave steeds and cups of gold.
None richer abeun mould;
Some gave he hauberks, some greyhounds,
Some rich robes worth many pounds,
Some mantels with veir and gris,
And some *Mazers* of rich price."

In Chaucer's "Rime of Sire Thopas," in the Canterbury Tales, when the Knight is preparing for the combat with Sire Oliphant, the giant with three heads, his merry men are commanded to make him both game and glee, to rouse him for the fight; and along with other cheering restoratives:—

"They fetch him first the sweet wine,
And mede eke in a mazelin,
And real spicery."

Spenser furnishes a beautiful description of a highly-wrought emblematical mazer cup, in his Shepherd's Callendar, evidently suggested by the bowl for which the shepherds contend in Virgil's Third Pastoral:—

"Lo Perigot the pledge which I plight,
A mazer ywrought of the maple ware,
Whereon is enchased many a fayre sight,
Of bears and tigers that maken fiers war;
And over them spread a goodly wild vine,
Entrailed with a wanton ivy twine.

"Thereby is a lamb in the wolf's jaws;
But see how fast runneth the shepherd swain
To save the innocent from the beaste's paws,
And here with his sheep hook hath him slain.
Tell me, such a cup hast thou ever seen?
Well might it become any harvest Queen."

Dryden, in rendering the corresponding passage from Virgil, adheres to the Classic designation of a beechen bowl, though he refers to it elsewhere as a mazer. Nor were the virtues of the maple, the "acerque coloribus impar" of Ovid, unappreciated by the ancients. Virgil constructs his throne for the good Evander, of maple inlaid with ivory. Pliny enlarges on its virtues, and frequent notices occur of its use by the Romans in the construction and enlarging of their costliest furniture. Its ancient British repute partakes more of the social character of the Anglo-Saxon. The favourite wassail drink of our ancestors, made of roasted apples, sugar, and ale, appears to have been specially associated with the maple bowl. The old English wassail quatrain indeed runs thus:—

"Wassail! wassail! all over the town,
Our toast it is white, our ale it is brown;
Our bowl it is made of a maplin tree,
We be good fellows all; I drink to thee."

One of the quaint entries in Pepys's Gossiping Diary is: "On the 4th January, 1667, Mrs. Pepys had company to dinner, and at night to sup, and then to cards, and last of all to have a flagon of ale and apples, drunk out of a wood cup, as a Christmas draught, which made all merry." The Christmas mirth of the old diarist, while it recalls, may serve to illustrate the practical jests of "That shrewd and knavish sprite called Robin Good-fellow," as narrated by himself in the "Midsummer Night's Dream:"—

"And sometimes lurk I in a gossips bowl,
In very likeness of a roasted crab;
And when she drinks, against her lips I bob,
And on her withered dew-lap pour the ale."

The mazer is more distinctly referred to by Shakspeare's cotemporaries, Beaumont and Fletcher, in the beautiful song of Maximus, introduced in the last scene of "Valentinian:"—

"Good Lyæus ever young,
Ever honored ever sung;
Stained with blood of lusty grapes,
In a thousand lusty shapes,
Dance upon the Mazer's brim,
In the crimson liquor swim;
From thy plenteous hand divine
Let a river run with wine."

Such illustrations from the poets, as well as the notices n ancient inventories and deeds, might readily be extended, with a little research, but I shall only quote one other metrical reference to the Mazer, which occurs in the old Scottish Ballad of Gill Morice. Lord Bernard, roused to wrath by the message brought by Gill Morice's page to his lady, is thus described in the homely but graphic language of the old minstrel:

"Then up and spak the bauld baron,
An angry man was he;
He's taen the table wi' his foot,
Sae has he wi' his knee,
Till siller cup and mazer dish
In flinders he garr'd flee."

From the pious legends frequently inscribed on many of these ancient cups, they have been occasionally described by modern writers as sacred vessels designed only for religious uses. The use of wooden vessels as chalices, was, however, for obvious reasons, abandoned at an early period, so that the *calices lignei* became in later times a proverbial illustration of the obsolete simplicity of primitive ages. The old Scottish Jurist, Fountainhall, in moralizing in his "Historical Notes," on the wealth first acquired by the church in the seventh century, exclaims: "We may now take up that old regrait: when there were *calices lignei* there were then *sacerdotes aurei*, but now when our chalices are of gold and silver, we have got *ligneos sacerdotes*." Another old Scottish writer revives the idea of the *calices lignei*, in a quaint, but very beautiful allusion to the Mazer cup, referred to metaphorically as a sacramental chalice. It occurs in Zacharie Boyd's "Last Battell of the Soule," published at Edinburgh in 1629: "Take now," says he, "the cup of salvation, *the great Mazer of his mercy*, and call upon the name of the Lord." The character of the inscriptions on the ancient Mazers, whether of wood, or the precious metals, notwithstanding the quaint piety of some of these legends,

generally suffices to put at rest all idea of their use otherwise than at the social board. It would be easy to multiply examples, did not I fear that I have already encroached too long on your patience, in this antiquarian ramble suggested by our Canadian maple leaf. The collegiate treasuries of Oxford still boast several costly Mazers, which have escaped the destruction of the great civil war; and Pembroke College, Cambridge, possesses a beautiful example, silver gilt and with this jovial couplet engraved round the bowl.

"Sayne Denis yt es me dere,
For he's lof drink and mak gud cher."

On the stem, also, is the pious invocation: "God help at need;" which yet, in company with that round the bowl, precludes all idea of its use for the altar. Let me, however, rather close this notice of the maple bowl, with the description of one of the 17th century now in the collection of an old friend, Mr. W. Johnston of Edinburgh. It is made of maple, curiously carved with animals, trees, and flowers: the unicorn, the stag, the hedgehog, and an ostrich regaling itself with a horse-shoe; while the unoccupied surface is copiously inscribed with pious aphorisms in prose and verse. Round the rim of the stand are the words and date:—

"They that seeke after the Lord shall prayse him, their harts shall live forever. 1611."

On the bowl of the cup is the inscription:—

"The fountayne of all health and wealth and joyes
To thirsty soules, he giveth drink indeed;
Such as turne to him from their evill wayes
Shall finde sound comfort in their greatest neede.
But evill workers that in sinne remaine
They are ordayned to eternall payne.

"For every one of us shall be rewarded according to our workes, therefore repent unfaynedly and amend."

But the most characteristic part of the inscription lurks modestly on the under side of the stand, where the Mazer thus takes up the hortatory strain in *propria persona*:—

"Missuse me not although I am no plate;
A Maple Cupp that is not out of date;
Drinke well and welcome, but be not too free;
Examine whether that in Christ you be;
If that your faithe be true, and firm, and sound,
Then in all good workes you will still abound.
So run that ye may obtayne."

One can scarcely avoid fancying there was a little quiet humour lurking in the mind of the carver, when he inscribed these latter excellent and very practical maxims on the under side of the stand, where it was only possible to peruse them when the cup was emptied; as doubtless it has often been by the Cavaliers of the Commonwealth, and the jolly roysterers of the Restoration. Out of just such a piously inscribed Mazer-bowl one can fancy the gossiping, moralising, but woefully temptible old diarist, Mr. Secretary Pepys, drinking his Christmas wassail-draft of ale and apples, "which made all merry."

But the Mazer has had its memory revived in the modern poet's page. It is one interesting result of the curious alliance effected between the antiquary and the muses, by Sir Walter Scott,—who loved, even when, as in his "Antiquary," he laughed at such old world pursuits,—that while no later English poet than Dryden refers to the Mazer cup, it figures once more in the Scottish poem: the "Lord of the Isles;" and with this, the latest allusion to the ancient wassail bowl constructed of the maple tree, or associated with its name and use, I shall close these desultory illustrations of the Canadian and English maple. Founding his allusions on the notice of the four Mazers of King Robert the Bruce among the treasures of James III. that King is thus introduced as celebrating the recovery of his father's halls:—

"Bring here, he said, the Mazers four
My noble fathers loved of yore.
Thrice let them circle round the board,
The pledge fair Scotland's rights restored!
And he whose lips shall touch the wine
Without a vow as true as mine,
To hold both lands and life at nought
Until her freedom shall be bought,—
Be brand of a disloyal Scot,
And lasting infamy his lot."

CANADIAN INSTITUTE.

Council Meeting—September 21st, 1855.

The subject of a new series of the *Journal* was discussed, and the following programme adopted:—

Canadian Journal—New Series.

1. The *Journal* to be published in octavo form, each alternate month, beginning with January, 1856.

2. All original Communications to be inserted first, under this or some similar general heading, and whether long or short, to have invariably the name or initials of the Author.

3. Original Reviews to form the Second Division in each number, and Reports of the Meetings of the Institute and other Societies, the Third Division.

4. All matter derived from published sources, to be printed in small type, and form a distinct division, or appendix, under the title of "Scientific and Literary Excerpts," or some other similar heading.

5. The conduct of the *Journal* to be entrusted to an Editing Committee, to be annually nominated by the Council from the general body of the Members of the Institution, at their last meeting in April.

6. The Council to elect one of their Editing Committee as Convener, who shall perform the duties of General Editor in the conduct of the *Journal*, receiving and transmitting communications and works for reviews to the members of the Committee, to whom their subjects pertain; and exercising the general oversight requisite for the successful issue of a periodical publication.

7. The Convener to summon the Committee, once at least in the interval between the publication of each number, to deliberate on the contents of the succeeding number.

8. To be incumbent on each Member of the Editing Committee, to endeavour to obtain original communications of interest and value in his own department, in addition to his own personal contributions.

9. The duties of the Editing Committee, to be classified and divided among its members, according to the following sub-divisions, subject to alteration or addition by the Council.

SUB-COMMITTEES.

I. Geology.—E. W. Logan, F.R.S. & G.S., Director of the Provincial Geological Survey; Henry Y. Hind, M. A., Professor of Chemistry, Trinity College, Toronto.

II. Physiology and Natural History.—James Bovell, M. D., Professor of the Institutes of Medicine, Trinity College, Toronto.

III. Ethnology and Archæology.—Daniel Wilson, L. L. D., Professor of History, University College, Toronto.

IV. Chemistry and Mineralogy.—Henry Croft, D. C. L., Professor of Chemistry, University College, Toronto; J. G, Chapman, Professor of Mineralogy, University College, Toronto.

V. Mathematics and Natural Philosophy.—J. B. Cherriman, M. A., Professor of Mathematics, University College, Toronto; Rev. G. C. Irving, M. A., Professor of Mathematics, Trinity College, Toronto.

VI. Engineering and Architecture.—

10. To be incumbent on Editors of Sections, to read for the press all Communications in their own departments.

11. The Council to have supreme control of the *Journal;* but no article to be admitted contrary to the wishes of a majority of the Editing Committee.

Council Meeting—October 13th, 1855.

The following gentlemen were provisionally elected members of the Institute:—

W. M. Matheson	Toronto.
Professor Young	Knox's College, do.
L. A. H. Latour	Montreal.
Charles W. Coverton, M. D.	Simcoe.

Council Meeting, October 27th, 1855.

The Second Vice-President announced that His Excellency the Governor-General had consented to officiate at the Laying of the Foundation-stone of the proposed Institute Building.

It was resolved that the Rev. H. J. Grasett be requested to act as officiating clergyman on that occasion.

Committees, composed of members of Council, were appointed to collect subscriptions towards the Building Fund from the members of the Institute in separate divisions of the City.

A copy of the American Journal of Science and Art was ordered to be sent to various Toronto publishers, to obtain estimates per sheet for printing the New Series of the *Canadian Journal* after the typographical model of that publication.

It was resolved that Daniel Wilson, LL.D., Professor of History, University College, be requested to act as Convener of the Publishing Committee.

Council Meeting, November 10th, 1855.

The following gentlemen were provisionally elected members of the Institute:—

Larratt W. Smith, D.C.L	Toronto.
A. Sullivan	"
Thos. W. Lawford	London.
John Patton	Toronto.
Professor Kingston, M.A	University College, do.

Council Meeting, November 20th, 1855.

The following gentlemen were provisionally elected:—

Moses H. Parly	St. John's, N.B.
W. McMaster	Toronto.
A. Bostwick	"
George Beatty, Secretary, O.S.H.R.R.	"
Andrew Russell	"

The Indenture drawn up by Mr. Mowat, respecting the Transfer of Books, &c., from the Athenæum to the Canadian Institute, was laid on the table and ordered to be executed.

It was resolved that the Corresponding Secretary be directed to convey to Mr. Mowat the thanks of the Council, for his valuable services in completing the arrangements with the Athenæum.

QUEBEC LITERARY AND HISTORICAL SOCIETY.

At the first Stated Meeting of the Season, held at the Society's rooms, Henderson's Buildings, St. Lewis Street, on Wednesday evening, 3rd October, Lieut. A. Noble, Royal Artillery, F.R.A.S., was elected Vice-President, in the place of G. T. Kingston, Esq., M.A., removed to Toronto. F. N. Boxer, Esq., was elected Recording Secretary, in the place of Henry E. Steele, Esq., removed to Toronto. The Secretary announced a donation to the Society from Robert Symes, Esq., life-member, consisting of portions of the original Indian costume, worn by him as "Hotsawath," Chief of the Huron Tribe, when the Historical Painting in possession of this Society was painted by H. D. Thielcke. Also, from the same donor, an embroidered cushion formerly used on the altar of the old church at the Indian village of Lorette, and which was brought to this country by the early Jesuit missionaries from France. Also, and from the same, the original "Registers of Interments at the hospitals and the city of Quebec, during the visitations of cholera in the years 1849 and 1851. Other donations during the summer:—from the Rhode Island Historical Society, "Discourse on the Life and Times of John Howland, Pres. R. I. H. Society, by E. B. Hall, D.D.;" from the Hon. East India Company, "Meteorological Observations, Madras, 1851;" from the Royal Society, Edinburgh, "Proceedings of Session, 1853–54;" from T. D. Harrington, "Account of Scientific Discovery, 1854;" from Lieut. Savage, R.E., "Russia as it is," by Growski; "Cornhill to Cairo," by Titmarsh.

At the second Stated Meeting, held Wednesday, 17th October, an interesting paper, entitled, "Reminiscences whilst assisting to draw the boundary line between the United States and the B.N.A. Provinces, in 1843," was read by Mr. Boxer. The Secretary announced a donation to the Library from Lieut. Savage, R.E., Vice-President, viz.: "Papers on the corps of Royal Engineers, "The Night Side of Nature," and "Hard Times." Intimation being received of the departure of E. T. Fletcher, Esq., for Toronto, Dr. R. H. Russell was requested to act as Librarian in his stead, till the ensuing annual election of officers.

At the third Stated Meeting, held Wednesday, 7th November, the Council Secretary announced the receipt of a manuscript for one of the Society's prizes of the current year, entitled, "An Essay on Art in Architecture." The Secretary announced the following donations to the Library, viz.: from Noel H. Bowen, Esq., "Faust, a dramatic poem," and "The Bloodstone," by Donald McLeod; from F. N. Boxer, Esq., "Correspondence between the Chief Superintendent of Schools, C.W., and other persons, on Separate Schools." An entertaining paper on Entomology was then read by Mr. Savage, R.E., Vice-President.

At the Monthly General Meeting, held Wednesday afternoon, 14th November, the following gentlemen were elected associate members of the Society: Richard Penniston White, James Dunbar, and James Martin, M.D. E. The Librarian, Curators, and Corresponding Secretary had no reports to present. Mr. Boxer presented to the Library "Scott's Dæmonology."

GEORGE T. CARY,

Treasurer and Assistant Secretary.

Quebec, 17th November, 1855.

MONTREAL NATURAL HISTORY SOCIETY.

The ordinary monthly meeting of this Society was held in the Museum on Monday evening, October 29th, His Lordship the Bishop of Montreal in the chair. There were present Rev. A. D. Campbell, Drs. Workman, Scott, Hingston, Craik, D. C. McCallum, Barnston, Fraser, Trudel; and Messrs. Latour, Davis, Browne, Simms, Dutton and Rennie. The minutes of last ordinary meeting were read over and approved. Mr. W. H. A. Davis presented a copy of the revised By-laws, and reported that one of the Sub-Committee appointed to prepare them, Professor Andrews, had left this city for Quebec. The meeting filled up the vacancy thus created, by the appointment of Dr. McCallum. Read, a letter from Hector L. Langevin, Esq., of Quebec, a corresponding member of the Society, transmitting a copy of a French Work on Canada, written by him. Ordered, that the letter be acknowledged and the thanks of the Society returned to the donor for his contribution. Dr. Workman reported that in compliance with an application made by him to the Board of Directors, the Smithsonian Institute had forwarded for the Society a complete set of their valuable "Contributions to Knowledge." Ordered that the volumes be acknowledged, and the thanks of the Society returned to the Institute for their very generous and valuable donation. The meeting then proceeded to ballot for members, when R. Thomas, Esq., of Montreal, was declared unanimously elected an ordinary member, and Wm. Couper, Esq., of Toronto, a corresponding member. The election of a First Vice-President, in room of Professor Andrews, now residing in Quebec, was then commenced, the Chairman having appointed Dr. Workman and Mr. Dutton Scrutineers. Upon examining the votes, L. A. H. Latour, Esq., was found to have been duly elected; and in room of Mr. Latour, as Second Vice-President, W. H. A. Davis, Esq., was elected, and in room of Mr. Davis, as Third Vice-President, the Rev. A. D. Campbell was elected. The recommendation of the Council in their Annual Report to elect His Excellency Sir Edmund Head an Honorary Member of the Society, and which, in consequence of the absence of the requisite quorum prescribed by the Act of Incorporation, had hitherto not been acted upon, was next taken into consideration, and the Governor General elected by acclamation. Dr. Fraser, Chairman of the Lecture Committee, stated that so soon in January as their new Lecture Room would be finished, the usual Winter Series of Lectures would be delivered by Members of the Society. Several names were already on the list, and the Committee had authorized him to express their hope that His Lordship would so far honour them as to inaugurate the Course. The Chairman said, that although they must not expect him to deliver a Scientific Lecture, he would most certainly open the Course. This the Society would naturally expect from the position which he held as its President; and though he had as yet been able to do but little in that capacity to help them on, he would gladly introduce their lectures if they felt it would assist them. The announcement was received with applause, and the meeting adjourned.

A. N. RENNIE,
Recording Secretary

Geology in America.

(*Continued from page* 361.)

There are the following epochs in the Post-tertiary: the *Drift epoch*, the *Laurentian epoch*, an epoch of depression; the *Terrace epoch*, an epoch of elevation—three in number, unless the Drift and Laurentian epochs are one and the same.

As this particular point is one of much interest in American geology, I will briefly review some of the facts connected with the drift.

The drift was one of the most stupendous events in geological history. In some way, by a cause as wide as the continent, and I may say, as wide nearly as the world, stones of all sizes to immense boulders one to two thousand tons in weight, were transported, along with gravel and sand, over hills and valleys, deeply scratching the rocks across which they travelled.

Although the ocean had full play in the many earlier ages, and an uneasy earth at times must have produced great convulsions, in no rock strata, from the first to the last do we find imbedded stones or boulders at all comparable in magnitude with the immense blocks that were lifted and borne along for miles in the Drift period.

Much doubt must remain about the origin of the drift until the courses of the stones and scratches about mountain ridges and valleys shall have been exactly ascertained. The general course from the north is admitted; but the special facts proving or disproving a degree of dependence on the configuration of the land have not yet been sufficiently studied.

One theory, the most prevalent, supposes a deep submergence over New England and the north and west, even to a depth of four or five thousand feet, and conceives of icebergs as floating along the blocks of stone and at bottom, scratching the rocks. Another, that of the Professors Rogers, objects to such a submergence, and attributes the result to an incursion of the ocean from the north, in consequence of an earthquake movement beneath the Arctic Seas.

The idea of a submergence is objected to, on the ground that the sea has left no proofs of its presence by fossils or seashore terraces or beaches. Unless the whole continent were submerged, of which there is no evidence whatever, there must have been in the Post-tertiary period an east and west line of seashore, say across New Jersey, Pennsylvania, Southern Ohio, and other States west, or still further south; and yet no such seashore marks now exist to trace its outline —although the ocean must have been a portion of the same that had laid up the cretaceous and tertiary beds all along the coasts, and in fact already contained the oysters and clams and many other species of Molluscs which now exist.

Can it be that, contrary to all the ways of the past, such a grand submergence as this view supposes, placing New England 4,000 feet under water, could have transpired without a seashore record? Very many have replied in the affirmative; and one able advocate of this view, who sees no difficulty in the total absence of seashore terraces or fossils at all levels above the Laurentian beds, finds in the succeeding epochs seashore accumulations in all the terraces of our rivers. Why this wonderful contrast? What withheld the waves from acting like waves in the former case, and gave unbounded license in the latter?

This much then seems plain, that the evidence, although negative, is very much like positive proof, that the land was not beneath the sea to the extent the explanation of the drift phenomena would require.

There are other objections to this view of submergence. If North America was submerged from the southern boundary line of the drift far into the Arctic regions, this would have made a much warmer climate for the continent than now; and if only half way, then there is another east and west shore line to be traced out before the fact of the submergence can be admitted.

Again, we know how the ice, while yet a glacier or along a shore of cliffs, (for all bergs were once glaciers,) may receive upon it heavy blocks of stone, even a thousand tons in weight, and bear them off to distant regions, as now happens in the North Atlantic; but we have no reason to believe that the massy foot of a berg could pick up such blocks, and carry them twenty miles to drop them again; and hence the short distance of travel would seem to prove that the bergs were made at that short distance to the north, and this implies the existence there of glacier valleys, and a glacier theory.

But without considering other difficulties, I pass to the inquiry whether the lands, if not submerged, were at any higher level than now?

There is evidence of a striking character that the regions or coasts over the higher latitudes, in both the northern and southern hemispheres, were much elevated above their present condition. The *fiords* or deep coast channels, scores of miles long, that cut up the coast of Norway and Britain, of Maine, Nova Scotia, and Greenland, of Western America from Puget's Sound north, of Southern South America from Chiloe south, of Van Diemen's Land and other southern islands—are all valleys that could not have been scooped out when filled with the ocean's water as now. That could have been formed only when the land in those high latitudes, north and south, was elevated till their profound depths were nearly dry. Whether this elevation was in the period of the Post-tertiary has not been precisely ascertained. But as they are proofs of a north-and-south system of oscillations, the same that was in action in the drift epoch, and as the cold that such a change

would occasion is not very distinctly apparent in the Tertiary period, and much less in the earlier, we have reason for referring the greater part of the elevation to that drift era, and for believing that the excavation of these fiord valleys was then in progress. Both fiords and drift are alike high-latitude phenomena on all the continents north and south. The change of climate between the Cretaceous and Tertiary, and the absence of tertiary beds north of Cape Cod, may have been connected with an incipient stage in this high-latitude movement.

However this be, there is other evidence in the cold of the drift period of some extraordinary cause of cold. The drift in Europe and Britain is generally attributed to glaciers and icebergs during a period of greater cold than now; and the fact of this greater cold is so generally admitted that it is common to speak of it as the glacial epoch. Prof. Agassiz, moreover, has urged for this continent the glacial theory.

In a memoir of great research, by Mr. Hopkins, of Cambridge, England, the able author maintains that this glacial cold might have been produced over Europe, partly at least, by a diversion of the Gulf-stream from its present position. He seems in his paper to attribute too much effect to the Gulf-stream and too little to the prevailing currents of the atmosphere; but setting this aside, it is unfortunate for the hypothesis that there is no reason to suppose that America was not then as much in the way of such a diversion as now. The small changes of level which the Tertiary and Post-tertiary of the Gulf have undergone, prove that the gate of Darien was early closed, and has since continued closed. America, as far as ascertained facts go, has not been submerged to receive the stream over its surface. If it had been, it would have given other limits to her own drift phenomena; for it is an important fact that these limits in America and Europe show the very same differences in the climates or in the isothermals, as that which now exists.

On the question of the drift, we therefore seem to be forced to conclude that, whatever be the difficulties we may encounter from the conclusion, the continent was not submerged, and therefore icebergs could not have been the main drift agents. The period was a cold or glacial epoch, and the increase of cold was probably produced by an increase in the extent and elevation of northern lands. Further than this, in the explanation of the drift, known facts hardly warrant our going.

If then the drift epoch was a period of elevation, it must have been followed by a deep submergence to bring about the depression of the Continent, already alluded to, when the ocean stood at least 400 feet in Lake Champlain, and a whale was actually stranded on its shores; and when the upper terrace of the rivers was the lower river flat of the valleys.

This submergence, judging from the elevated sea beaches and terraces, was 400 to 500 feet on the St. Lawrence and Lake Champlain; 80 feet at Augusta, Me.; 50 feet at Lubec; 30 feet at Sancoti Head, Nantucket; over 100 at Brooklyn, N.Y., and 200 to 250 in Central New England, just north of Massachusetts; while south in South Carolina it was but 8 feet.

But whence the waters to flood valleys so wide, and produce the great alluvial plains, constituting the upper terrace so immensely beyond the capability of the present streams? Perhaps, as has been suggested for the other continent, from the melting snows of the declining glacial epoch. The frequent absence of fine stratification, so common in the material of this upper terrace, has often been attributed to a glacial origin.

According to this view, the events of the Post-tertiary period in this country make a single consecutive series dependent mainly on polar or high-latitude oscillations. An elevation for the *first* or Glacial *epoch*; a depression for the *second* or Laurentian *epoch*; a moderate elevation again, to the present height, for the *third* or Terrace *epoch*.

The same system may, I believe, be detected in Europe; but, like all the geology of that continent, it is complicated by many conflicting results and local exceptions, while North America, as I have said, is like a single unfolding flower, in its system of evolutions.

There is the grandeur of nature in the simplicity to which we thus reduce the historical progress of the continent. The prolonged series of oscillations, acting by pressure from the south-east beneath the Atlantic, reach on through immeasureable ages, producing the many changes of level through the Silurian and Devonian, afterward with greater frequency in the Carboniferous, and then, rising with quickened energy and power, folding the rocks and throwing up the long range of the Apalachians with vast effusions of heat through the racked and tortured crust, next go on declining as the Jurassic and Cretaceous periods pass, and finally fade out in the Tertiary. The Northern oscillations, perhaps, before in progress, then begin to exhibit their effects in the high temperature latitudes, and continue to the Human Era. The sinking of Greenland now going on may be another turn in the movement; and it is a significant fact that while we have both there and in Sweden northern changes of level in progress, such great secular movements have nowhere been detected on the tropical parts of the continent.

In deducing these conclusions I have only stated in order the facts as developed by our geologists. Were there time for a more minute survey of detail the results would stand forth in bolder characters.

The sublimity of these continental movements is greatly enhanced when we extend our vision beyond this continent to other parts of the world. It can be no fortunate coincidence that has produced the parallelism between the Appalachian system and the great feature lines of Britain, Norway and Brazil, or that has covered the North and South alike with drift and fiords. But I will not wander, although the field of study is a tempting one.

In thus tracing out the fact that there has been a plan or system of development in the history of this planet, do we separate the Infinite Creator from his works? Far from it; no more than in tracing the history of a plant. We but study the method in which Boundless Wisdom has chosen to act in creation. For we cannot conceive that to act without plan or order is either a mark of divinity or wisdom; and assuredly it is far from the method of the God of the Universe, who has filled all Nature with harmonies; and who has exhibited his will and exalted purpose as much in the formation of a continent, to all its details, as in the ordered evolution of a human being. And if man from studying physical nature begins to see only a deity of physical attributes, of mere power and mathematics, he has but to look within at the combination of the affections with intellect, and observe the latter reaching its highest exaltations when the former are supreme, to discover that the highest glory of the Creator consists in the infinitude of his love.

My plan laid out in view of the limited time of a single address, has led me to pass in silence many points that seemed to demand attention or criticism; and also to leave unnoticed the labors of many successful investigators.

There are some subjects, however, which bear on general geology that should pass in brief review:—

I. The rock-formations in America may in general be shown to be synchronous approximately with beds in the European series. But it is much more difficult to prove that catastrophes we.e synchronous; that is, revolutions limiting the ages or periods.

The revolution closing the Azoic age, the *first* we distinctly observe in America was probably nearly universal over the globe.

An epoch of some disturbance between the Lower and Upper Silurian is recognized on both continents. Yet it was less complete in the destruction of life in Europe than here—more species there surviving the catastrophe; and in this country there was but little displacement of the rocks.

The Silurian and the Devonian ages each closed in America with no greater revolutions than those minor movements which divided off the subordinate periods in those ages. Mr. Hall observes that they blend with one another and the latter also with the Carboniferous; and that there is no proof of cotemporaneous catastrophe, giving them like limits here and in Europe. But after the Carboniferous came the Appalachian revolution, one of the most general periods of catastrophe and metamorphism in the Earth's history. Yet in Europe the disturbances were far less general than with us, and occurred along at the beginning and end of the Permian period.

From this epoch to the close of the Cretaceous, there were no cotemporaneous revolutions, as far as we can discover. But the Cretaceous period terminates in an epoch of catastrophe which was the most universal on record—all foreign cretaceous species having been exterminated, and all American with a few doubtful exceptions. This third general revolution was the prelude to the Mammalian age.

But there is no time to do this subject justice, and I pass on, merely adding, on account of its interest to those who would understand the first chapter of Genesis, that there is no evidence whatever in geology that the Earth after its completion passed through a chaos and a six days' creation at the epoch immediately preceding man, as Buckland in the younger days of the science suggested on *Biblical*, not on geological ground. No one pretends that there is a fact or hint in geology to sustain such an idea; moreover the science is totally opposed to it.

II. The question of the existence of a distinct *Cambrian System* is decided adversely by the American records. The Molluscs, in all their grand divisions appear in the Lower as well as the Upper Silurian, and

the whole is equally and alike the Molluscan or Silurian Age. The term Cambrian, therefore, if here used for fossiliferous strata, must be made subordinate to Silurian.

The *Taconic System* of Emmons has been supposed by its author to have a place inferior to the Cambrian of Sedgwick, or else on a level with it. But the investigations of Hall, Mather, and Rogers, and more lately of Logan and Hunt, have shown that the Taconic slates belong with the upper part of the Lower Silurian, being in fact, the Hudson river Shales, far from the bottom of the scale.

III. The American rocks throw much light on the origin of coal. Prof. H. D. Rogers, in an able paper on the American coal fields, has well shown that the condition of a delta or estuary for the growth of the coal plants, admitted even now by some geologists, is out of the question, unless the whole continent may be so called; for a large part of its surface was covered with the vegetation. Deltas exist where there are large rivers; such rivers accumulate and flow where there are mountains. How then could there have been rivers or true deltas of much size in the coal period, before the Rocky Mountains or Appalachians were raised. It takes the Andes to make an Amazon. This remark has a wider application than simply to the coal era.

IV. In this connection, I add a word on the idea that the rocks of our continent have been supplied with sands and gravel from a continent now sunk in the ocean. No facts prove that such a continent has ever existed, and the whole system of progress, as I have explained, is opposed to it. Moreover, gravel and sands are never drifted away from seashores except by the very largest of rivers like the Amazon; and with these, only part of the lightest or finest detritus is carried away; for much the larger part is returned to the coast through tidal action, which has a propelling movement shoreward where there are soundings. The existence of an Amazon or any such Atlantic continent in Silurian, Devonian, or Carboniferous times, is too wild an hypothesis for a moment's indulgence.

V. The bearing of the facts in American Palæontology on the science might occupy another full discourse, I will close with brief allusions to some points of general interest.

1. The change in the Fauna of the Globe as the Age of Man approached, is one of the most interesting facts in the Earth's history. It was a change, not in the types of the races—for each continent retains its characteristics—but a remarkable dwindling in the size of species. In North America, the Buffalo became the successor to the huge Mastodon, Elephant and Bootherium; the small beaver to the great Castoroides, and the existing Carnivora are all comparatively small.

Parallel with this fact we find that in South America, as Dr. Lund observes, where in the last age before Man, there were the giant Megatherium, and Glyptoden and other related Edentata there are now the small Sloths, Armadillos, and Ant-eaters.

So, also, in the Oriental Continent the gigantic lion, tiger, hyena, and elephant, and other monster quadrupeds, have now their very inferior representatives.

In New Holland, too, the land of Marsupials, there are Marsupials still, but of less magnitude.

2. The American Continent has contributed to Science a knowledge of some of the earliest traces of reptiles—the species of the Pennsylvania coal formation, described by Dr. King and Mr. Lea, and others from the Nova Scotia coal fields, discovered by Messrs. Dawson and Lyell.

It has afforded the earliest traces of birds thus far deciphered in geological history—the colossal and smaller waders whose tracks cover the clayey layers and sandstones of the Jurassic rocks in the Connecticut Valley. The earliest Cetacea yet known are from the American Cretaceous beds, as described by Dr. Leidy, and among the large Mammals which had possession of the renewed world after the Cretaceous life had been swept away, the largest, as far as has been ascertained, lived on this continent. The Palæotheria of the Paris basin, described by Cuvier, were but half the size of those of Nebraska.

But here our boasting ceases; for as Agassiz has shown, the present Fauna of America is more analogous to the later tertiary of Europe than to the existing species of that continent.

In the P alæozoic Ages, to the close of the Coal Period, the American Continent was as brilliant and profuse in its life as any other part of the world It was a period, indeed, when the globe was in an important sense a unit, not individualized in its climates or its distribution of life, and only partially in its seas. But from this time the contrast is most striking.

The whole number of known American species of animals of the Permian, Triassic, Jurassic, Cretaceous, and Tertiary periods is about 2,000; while in Britain and Europe, a territory even smaller, there were over 20,000 species. In the Permian we have none; while Europe has over 200 species. In the Triassic none, Europe 1,000 species; in the Jurassic 60, Europe over 4,000; in the Cretaceous 350, Europe 5,000 to 6,000; in the Tertiary less than 1,500, Europe about 8,000.

America, since Palæozoic times, has therefore been eminent for the poverty of its Fauna.

Again, the Mammalian Age in America, although commencing with huge Pachyderms, shows little progress afterward. The large quadrupeds continue to be mainly herbivorous, and the Carnivora, the higher group, are few, and of comparatively small size. The *Herbivora are still the typical species.* While in Europe and Asia, at the same time—that is, in the Post-tertiary—the Carnivora are of great size and ferocity far exceeding the largest of modern lions and tigers. The single species of lion described from a bone from near Natchez, by Dr. Leidy, hardly lessens the contrast.

South America, as has been remarked by Agassiz and others, sustains this inferior position of America. The huge sloths, megatheria, and other Edentata of the South are even lower in grade than the ordinary Herbivora, and place the southern continent at an inferior level in the scale. Although there were Carnivora, they were much smaller than the European, The *Edentates are, in fact, its typical species.*

The supremacy of the great Oriental Continent is therefore most signally apparent.

The contrast is still greater with Australia and New Zealand, whose past and present Fauna and Flora have been well said, by Agassiz, and afterwards by Owen, to represent the Jurassic period, the present era affording Trigonias, Terebratulæ, Cestraciont Fishes, and the Araucarian Coniferæ, all Jurassic types, beside kangaroos and moas. Among Mammals, the *Marsupials*, the lowest of all in the class, *are its typical species.*

Ever since Palæozoic times, therefore, the Oriental Continent—that is, Europe, Asia, and Africa combined—has taken the lead in animal life. Through the Reptilian age, Europe and Asia had species by thousands, while America was almost untenanted. In the later Mammalian age, North America was yet in the shade, both in its Mammals and lower tribes, South America in still darker shadows, and Australia even deeper still. The earth's antipodes were like light and darkness in their zoological contrasts. And was there not in all this a prophetic indication, which had been growing more and more distinct, that the Eastern continent would be man's chosen birth-place? that the long series of living beings which had been in slow progression through incalculable ages would there at last attain its highest exaltation? that the stupendous system of nature would there be opened to its fullest expansion?

Another of our number has shown, in eloquent language, how the diversified features and productions of the Old World conspired to adapt it for the childhood and development of the race; and that when beyond his pupilage, having accomplished his rescue from himself and the tyranny of the forces around him, and broken the elements into his service, he needed to emerge from the trammels of the school-house in order to enjoy his fullest freedom of thought, and action, and social union. Prof. Guyot observes further, that America, ever free, was the appointed land for this freedom and union, of which its open plains and oneness of structure were a fit emblem; and that, although long without signs of progress or hope in its future, this land is to be the centre of hope and light to the world.

In view of all these arrangements, Man may well feel exalted. He is the last of the grand series. At his approach the fierce tribes of the earth drew back, and the race dwindled to one-fourth its bulk and ferocity—the huge mastodons, lions, and hyenas yielding place to other species better fitted to be his attendants, and more in harmony with the new creation. Partaking of the Divine image, all nature pays him tribute; the universe is his field of study; and eternity his future. Surely it is a high eminence on which he stands.

But yet he is only *one* in the series—one individuality in the vast system. How vain the philosophy which makes the creature the God of Nature, or Nature its own author. Infinitely beyond man, infinitely beyond all created things is that Being, with whom this system and the combined systems of immensity were as one purpose of His will.

African Explorers:—Barth and Vogel.

A telegraphic despatch from Dr. H. Barth, dated "Marseilles, 8th of September, 11·5 a.m.," received by me at Gotha this day, at 2·5 p.m., conveys the gratifying intelligence that this extraordinary man, already believed dead, set his foot on European shore this morning, *en route*

for London, to present himself to the Foreign Office. He intends to remain in London till about the 20th instant, and then to hasten on to Hamburgh, his native town, where his aged father and sister reside.

It may not be uninteresting to recapitulate, on the very successful and happy termination of this most arduous and hazardous undertaking of Dr. Barth, a few of the principal dates of his journeys.

It was on the 8th of December, 1849, that he left Marseilles for North Africa, in company with the late Dr. Overweg. Having arrived at Tripoli, the two travellers explored the Gharian mountain, during the month of February, 1850, after which they started for Lake Tsad, together with the late Mr. Richardson, on the 23rd of March. Travelling by way of the Oases of Ilessi and Shiati, Murzuk and Jerdalus, they arrived at the Kasar Janoon, or Palace of the Demons, in the vicinity of Ghat, on the 15th of July. In exploring this celebrated group of hills Dr. Barth nearly perished, for he lost his way in the desert, was twenty-eight hours without water, and suffered the most horrible tortures from thirst, having drunk his own blood. Passing by Ghat, Talesseles, and Aison, the travellers entered the kingdom of Air, or Asben, on the 21st of August. Here Dr. Barth, by his firm and resolute bearing against an attacking body of Tuaricks, saved the Expedition from an ignominious retreat back to the north. Afterwards, while his companions remained at Tintellust, he undertook, alone, a journey to Agadez, the capital (4th Oct. to 6th Nov.), by which he greatly added to the store of our knowlege of Northern Africa.

The Expedition entered Sudan on the 1st of January, 1851, and arrived at Tagelal on the 11th, where the travellers separated,—Dr. Barth taking the route to Kashna and Kano. In this place he collected a great deal of information. While on his march to Kuka, he received the sad news of Mr. Richardson's death, which took place at Ungurutua on the 4th of March. With praiseworthy energy he hastened on to that place in order to fulfil the last duty to his travelling companion. He secured all his papers and transmitted them to London, where they were shortly afterwards published.

Arriving at Kuka on the 2nd of April, he found the whole Expedition disorganized and in a very disheartening condition, from being without provisions and means, their funds being entirely exhausted. But he succeeded in borrowing a sum of money from the Vizier of Bornu, paid the debts incurred by Mr. Richardson, and thus saved the Expedition a second time from failure by his well-timed energy and perseverance.

On the 29th of March, 1851, Dr. Barth undertook his memorable journey to Adamawa, in which he discovered the River Binue, by means of which, the long-hidden and hitherto inaccessible regions of Central Africa have been thrown open to English enterprise.

Dr. Barth, having returned to Kuka from Adamawa on the 22nd of July, explored Kanem from September to November, in company with Dr. Overweg, and then penetrated in a direction of SSE. from Kuka, as far as Musgo and beyond, from the 25th of November to the 1st of February, 1852.

Dr. Barth, once more single-handed, undertook another journey, from the end of March to the 20th of August, in which he pushed his way eastwards across the river Shary into Bagirmi and as far as its capital, Maseña, by which journey he added considerable to our knowledge of the countries east and south-east from Lake Tsad, as far as the basin of the Nile.

On the 27th of September, 1852, Dr. Barth lost his only companion and friend, Dr. Overweg, who died on the borders of Lake Tsad: but his own health being unimpaired, he determined, with true heroism, to continue his researches alone, and undertook his bold journey to Timbuktu. He left Kuka on the 25th of November, 1852, reached Kashna in February, 1853, Sakatu in the beginning of April, and entered Timbuktu on the 7th of September. After a protracted stay of nearly a year at this famous place, he made his way back to Kano, which he reached on the 17th of October, 1854; and on the 1st of December last met Dr. Vogel between that place and Kuka. Thence he re-crossed the Sahara to Tripoli, and thus finally reached Marseilles.

In his unparalleled journey to Timbuktu, Dr. Barth discovered two large empires, Gando and Hamd-Allahi, of which not even the names were known previously,—he gained a complete insight into the history and present state of Timbuktu, its people, and all the surrounding countries,—and, for the first time, made a minute survey of the River Kowara in its middle course,—and altogether created a new era in the history of African discovery and regeneration.

A letter from Dr. Barth, dated Murzuk, July 20, and received after the despatch, contains also news of Dr. Vogel's progress and intended movements. This youthful explorer had reached the great and celebrated Fellata town, Yakoba, which Lander, Overweg, Barth, the Chadda Expedition, and others had previously been anxious to visit, without, however, succeeding; Dr. Vogel was the first European who reached Yakoba. The position of this very important point is, according to Dr. Vogel's astronomical observations—

10° 17′ 30″ north latitude,
9° 28′ 0″ east longitude Greenwich;

which is considerably different from all positions hitherto assumed, namely, much more to the north-west. From Yakoba Dr. Vogel intended to push his way to the south, across the Binue into Adamawa, to ascend the great mountain Alantika, situated south-east of Yola, and to penetrate as far as Tabati and Baya (see Dr. Barth's map published by me last year). Thence he intended to retrace his steps north-eastwards, in order to attempt the exploration of Waday.

AUGUSTUS PETERMANN.

Gotha, September 8th.

Singular Mortality amongst the Swallow Tribe, by Mr. E. J. LOWE.—There has seldom been recorded a more singular circumstance than the mortality amongst the swallow tribe, which occurred on the 30th and 31st of May in the present year.(Eng.) The unusually cold weather for this advanced season appears to have operated in producing the destruction of the greater number of this useful tribe of migratory birds. The severity of the weather causing a sarcity of insects (the ordinary food of the swallow), and rendering the birds too weak to enable them to search for food. On the 30th of May the swallows became so tame that they flew about the legs of persons, and could be caught without difficulty, on the following morning most of them lay dead upon the ground or in their own nests. In this neighborhood (near Nottingham) the greatest mortality was occasioned amongst the house swallow (*Hirundo rustica*), yet solely because this bird predominates. Near the Red Tunnel at Trumpton there are great numbers of sand-martins (*Hirundo raparia*), and there, in a saw-pit on the banks of the river Soar, hundreds congregated and died. At Borrowash, near the Derwent river, there are very many white martins (*Hirundo urbica*); they also congregated and died, lying ten and twenty deep on the different window-sills. Several persons opened their windows, and the birds were very willing to take shelter in the rooms, exhibiting no disposition to depart. Many were kept alive in the different houses by being fed with the *aphis* of the rose-tree, the only procurable insect. At Bulwell, Wollaton, Long Eaton, Gawley, and many other places, the same fearful mortality occurred. Farmers opened their barn-doors to admit the birds. To show the extent of the deaths, it may be mentioned that at one place where previously there were fifty nests occupied only six pair survived to take possession of them. The manner in which they congregated was a curious feature in the occurrence. A swallow would fly round a heap of dead and dying companions, and then suddenly dart down and bury itself amongst them. On the same days, in the vale of Belvoir, and parts of Nottinghamshire and Lincolnshire, several hundred newly shorn sheep perished.

On the Species of Meriones and Arvicolæ found in Nova Scotia, by Mr. J. H. DAWSON.—There appears to be two species of Meriones in Nova Scotia:—one of them is identical with *M. Labradorius* of Sir J. Richardson, differing only in some trifling characters; the second species is smaller, darker coloured, and has coarser hair. The average dimensions of three adult specimens are:—length of head and body, 3 inches 6 lines; tail, 4 inches 8 lines; tarsus and foot, 1 inch 4 lines. The author had not found any description of this last species; but would not desire to name it as a new species until he had made further inquiry. Should it prove to be new, he would claim for it the name *M. Acadicus*. This species inhabits grain fields. It does not burrow, but prepares forms in sheltered places, lying very close; and, when disturbed, escaping by a few rapid leaps or bounds. It feeds by day, and does not appear to prepare any store of food for winter. It is usually stated that these leaping mice are adapted to level and open countries; it therefore appears singular that in a country originally densely wooded two species should exist. Their natural habitat may have been those places from which the woods have been removed by fire, and replaced by herbaceous plants and shrubs. The most common Arvicola in Nova Scotia is the *A. Pennsylvanica*, which in form and habits closely resembles the European *A. vulgaris*. Its burrows, forming a neat nest, have two entrances, each with a sort of ante-chamber to enable the animal to turn itself. It excavates galleries under the snow in winter, devouring grass roots, bark of trees, &c.; and at the same season it often resorts to barns and outhouses.—*British Association at Glasgow.*

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—September, 1855.

Latitude, 43 *deg.* 39.4 *min. North. Longitude,* 79 *deg* 21. *min. West. Elevation above Lake Ontario,* 108 *feet.*

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Direct.	Mean Vel'y	Rain in Inch.
1	29·704	29·567	29·617	29·629	56°·4	79°·8	72°·8	71°·2	+ 8°·2	0·410	0·600	0·692	0·563	·92	·61	·89	·76	Calm	S E b S	W S W	S 32° W	11·63	0·425
2	·730	·764	—	—	61·7	71·6	—	—	—	·398	·387	—	—	74	51	—	—	NWbW	N W	N	N 18 W	10·38	0·035
3	·778	·767	·779	·772	57·2	59·9	51·9	55·6	— 6·8	·406	·361	·314	·352	88	72	82	81	E b N	E	N	E 41 N	7·81	...
4	·823	·882	·924	·875	49·9	63·2	55·6	57·2	— 4·9	·285	·415	·324	·336	81	74	75	73	N	E b S	N N E	E 31 N	7·50	...
5	·969	·939	·939	·944	55·5	68·8	57·1	61·2	— 0·6	·364	·386	·420	·398	85	57	92	78	N N E	E b N	N E	E 27 N	7·04	...
6	·968	·933	·909	·938	56·2	68·8	57·8	61·5	+ 0·1	·385	·464	·420	·433	87	67	90	82	N b E	E	N E	E 25 N	5·83	...
7	·937	·843	·779	·843	57·8	72·5	61·2	64·0	+ 2·8	·420	·539	·495	·487	90	70	94	84	N N W	S b E	Calm.	S 1 W	3·58	...
8	·760	·628	·619	·660	63·0	78·8	70·0	71·5	+10·8	·518	·649	·649	·585	92	68	91	78	W S W	S S W	S W	S 32 W	6·36	0·185
9	·673	·656	—	—	69·0	80·5	—	—	—	·514	·340	—	—	74	33	—	—	NWbN	NWbW	N b W	N 29 W	10·77	...
10	·746	·705	·662	·697	60·0	72·5	60·4	64·5	+ 4·5	·386	·481	·460	·441	76	63	89	75	N	S E b E	N E b N	E 1 S	3·84	...
11	·673	·592	·564	·607	57·1	78·0	71·0	70·2	+10·6	·420	·684	·638	·589	92	73	86	81	Calm.	S S E	SWbW	S 17 W	6·15	...
12	·579	·486	·483	·517	70·4	80·0	70·7	73·1	+13·8	·603	·666	·664	·626	84	67	91	80	S S W	S S W	W b S	W 24 S	12·54	0·240
13	·699	·781	·857	·785	59·2	65·0	51·7	58·9	+ 0·1	·460	·224	·282	·311	93	36	74	65	N	N b W	N b W	N 6 W	11·48	...
14	·870	·776	·710	·777	50·5	61·2	51·5	54·7	— 3·7	·282	·333	·290	·301	79	63	78	72	N E b N	E b N	N b E	E 34 N	8·79	...
15	·726	·636	·578	·640	48·5	66·5	55·3	58·0	+ 0·1	·258	·428	·417	·391	77	67	97	82	N	E S E	N b E	E 15 S	4·56	...
16	·575	·550	—	—	56·7	74·1	—	—	—	·423	·537	—	—	94	66	—	—	W b S	S b W	N b W	W 36 S	6·53	...
17	·663	·527	·427	·527	59·2	70·6	68·2	66·3	+ 9·3	·483	·586	·635	·570	98	81	95	91	N b W	E S E	S S W	S 8 E	4·93	2·535
18	·367	·662	·806	·632	65·7	50·1	45·9	53·3	— 3·3	·554	·301	·202	·329	90	85	66	77	N	N N E	N E	N 25 E	9·65	0·275
19	·998	30·006	30·003	30·016	39·5	49·5	42·4	44·1	—12·0	·160	·219	·218	·206	67	63	81	72	N E	S b E	N b E	E 27 N	5·76	...
20	·979	29·892	29·814	29·883	47·2	55·5	48·8	50·8	— 4·8	·212	·254	·291	·250	66	60	85	69	E S E	E b N	N b E	E 16 N	7·51	...
21	·739	·606	·601	·643	49·8	56·2	56·0	54·8	— 0·3	·320	·412	·420	·391	91	93	96	93	N b E	E N E	N E	N 27 E	2·52	0·010
22	·701	·766	·851	·779	56·0	58·3	53·0	55·5	+ 0·9	·420	·279	·323	·336	96	58	82	79	N N W	NWbN	N b W	N 14 W	8·69	...
23	·924	·919	—	—	50·6	61·4	—	—	—	·291	·359	—	—	81	67	—	—	N	S E b E	E S E	E 21 S	7·54	...
24	·873	·793	·773	·805	58·2	67·7	61·4	62·1	+ 8·4	·401	·468	·493	·457	84	71	92	84	S b E	S E	N E	E 41 S	5·57	0·550
25	·725	·596	·439	·570	62·1	69·3	62·6	65·2	+12·0	·504	·622	·506	·546	93	90	91	90	S S E	S E	E	S 34 E	5·29	0·895
26	·310	·247	·414	·326	65·0	72·7	54·6	64·0	+11·3	·566	·351	·374	·428	95	45	90	76	S	W b N	W b S	W 6 S	12·10	0·005
27	·537	·660	·770	·666	50·2	51·5	42·7	47·5	— 4·7	·283	·216	·214	·223	79	58	80	69	W	NWbW	NWbW	W 37 N	12·47	...
28	·864	·844	·824	·838	36·1	55·3	46·7	46·9	— 4·9	·191	·284	·278	·254	90	66	88	80	NWbN	S b E	E b N	E 12 S	4·99	...
29	·782	·688	·525	·656	44·5	59·0	58·9	55·0	+ 3·7	·264	·345	·405	·352	91	71	83	82	N E b N	E b N	S S E	E 8 S	7·23	0·385
30	·379	·468	—	—	59·9	63·0	—	—	—	·452	·484	—	—	89	87	—	—	S E b E	NWbN	N b W	W 12 N	9·42	0·045
M	29·751	29·713	29·707	29·721	55·0	65·2	57·1	59·5	+ 2·0	0·382	0·423	0·417	0·406	·86	·67	·86	·79	5·54	10·43	6·09	N 20 E	7·61	5·585

Highest Barometer...... 30·092, at 8 a.m. on 19th } Monthly range:
Lowest Barometer....... 29·247, at 2 p.m. on 26th } 0·845 inches.

Highest registered temperature 82°·6, at p.m., on 1st } Monthly range:
Lowest registered temperature 33°·0, at a.m. on 28th } 49°·6.

Mean Maximum Thermometer.............. 68°·44 } Mean daily range:
Mean Minimum Thermometer....... ...... 49°·94 } 18.51.

Greatest daily range.........28°·8, from p.m. of 26th to a.m. of 27th.
Least daily range ....11°·6, from p.m. of 20th, to a.m. of 21st.

Warmest day....... 12th. Mean temperature......73°·05 } Difference,
Coldest day......... 19th. Mean temperature......44°·12 } 28°·93.

Greatest intensity of Solar Radiation, 96°·4 on p.m. of 11th } Range,
Lowest point of Terrestrial Radiation, 27°·5 on a. m. of 28th } 68°·9.

Aurora observed on 2 nights: viz. on 10th and 27th.
Possible to see Aurora on 20 nights. Impossible on 10 nights.
Raining on 12 days. Raining 43·6 hours; depth, 5·585 inches.
Mean of Cloudiness, 0·45.
Thunder storms occurred on the 1st, 9th, 17th, and 25th.
Sheet lightning observed on the 8th and 11th.

The 17th was the most rainy day recorded at the Observatory since the 20th November, 1851.

Complete Saturation occurred at midnight of 21st.

28th, 6 a.m., Hoar Frost first observed this Season.

29th, Halo round the Moon at midnight, diameter 45°.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
2269·85	1415·13	1395·95	1739·76

Mean direction of Wind, N 20° E. Mean velocity 7·61 miles per hour.
Maximum velocity, 30·6 miles per hour, from 10 to 11 a.m. on 27th.
Most windy day, the 12th; mean velocity, 12·54 miles per hour.
Least windy day, the 21st; mean velocity, 2·52 " "

Most windy hour, 1 p.m.; Mean velocity, 10·55 miles per hour.
Least windy hour, 9 p.m.; Mean velocity, 5·37 " "
Mean diurnal variation, 5·18 miles.

The Mean Temperature of September, 1855, has been 1°·4 warmer than the average of the last 16 years; the depth of Rain which fell during the month was 1·127 inches on the surface greater than the mean monthly quantity; and the mean velocity of the wind recorded has also been greater than the average of the last 8 years by 2,47 miles per hour.

Comparative Table for September.

Year.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Wind. M'n Direc.	Mean Velocity in Miles.	
1840	54·0	—4·1	70·2	29·4	40·8	4	1·380	...	...	
1841	61·3	+3·2	79·9	37·5	42·4	9	3·340	...	0·26	lbs.
1842	55·7	—2·4	83·5	28·3	55·2	12	6·160	...	0·45	lbs.
1843	59·1	+1·0	87·8	33·1	54·7	10	9·760	...	0·57	lbs
1844	58·6	+0·5	81·5	29·6	51·9	4	impt.	...	0·26	lbs.
1845	56·0	—2·1	78·8	35·3	43·5	16	6·245	...	0·34	lbs.
1846	63·6	+5·5	84·0	39·0	45·0	11	4·595	...	0·33	lbs.
1847	55·6	—2·5	74·8	38·1	36·7	15	6·665	...	0·33	lbs.
1848	54·2	—3·9	80·9	29·5	51·4	11	3·115	W 19 N	5·81	Miles.
1849	58·2	+0·1	80·6	33·5	47·1	9	1·480	W 15 N	4·23	Miles.
1850	56·5	—1·6	76·0	31·7	44·3	11	1·735	W 24 S	4·78	Miles.
1851	60·0	+1·9	86·3	33·4	52·9	9	2·665	N 14 E	5·45	Miles.
1852	57·5	—0·6	81·8	36·1	45·7	10	3·630	W 17 N	4·60	Miles.
1853	58·8	+0·7	85·4	36·1	49·3	12	5·140	N 5 E	4·30	Miles.
1854	61·0	+2·9	93·1	36·3	56·8	14	5·375	N 18 W	4·31	Miles.
1855	59·5	+1·4	81·7	36·1	45·6	12	5·585	N 20 E	7·61	Miles.
									0·36	lbs.
M'n.	58·10		81·64	33·94	47·70	10·6	4·458		5·14	Miles.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——September 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. corrected and reduced to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direction of Wind.			Velocity in Miles per Hour.			Rain in Inches	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P. M.	10 P. M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	29·800	29·621	29·623	56·2	78·9	70·0	·432	·739	·692	·94	·78	·95	S W	S W b W	W	0·38	1·87	8·12	0·152	Cir. Cum. Str.	Cir. Cum. Str.10	Cum. Str. 4, thu.
2	·696	·884	·866	64·1	62·9	52·6	476	333	283	79	59	70	W N W	N W b W	N W b W	5·70	15·11	7·47	...	Cirr Str. 5. [6.	Str. 2.	Do. 4.
3	·972	·906	·951	44·0	69·3	49·7	271	486	312	87	69	86	N b W	E b N	S E b E	5·92	2·12	0·28	...	Str. 8.	Clear.	Do. 4.
4	30·056	30·061	30·102	52·1	72·0	57·9	330	584	335	85	76	78	E b N	E N E	E b S	0·76	2·19	0·75	...	Clear.	Do.	Clear.
5	·156	·119	·095	52·6	78·2	58·1	373	523	412	93	55	84	E b S	S W b W	S b W	Calm	1·12	0·20	...	Do.	Do.	Do.
6	·131	·086	·094	46·0	77·1	60·0	319	560	443	94	63	85	S b W	S b W	S b W	Calm	Calm	Inap.	...	Do.	Do.	Do.
7	·046	29·899	29·876	57·0	77·7	64·8	456	589	534	95	65	89	S b W	S b W	W b S	Calm	0·30	3·90	Inapp.	Do.	Cum. Str. 10.	Cum. Str. 10.
8	29·796	·718	·788	64·0	73·2	70·9	571	692	692	95	86	94	W b S	W b S	S W b S	1·40	1·77	0·92	...	Cum. Str. 4	Do. 10.	Clear.
9	·629	·598	·796	71·1	80·1	61·7	681	532	431	90	53	79	W b S	N W b W	N W	4·30	13·50	12·80	...	Clear.	Cum. 2.	Do.
10	886	·713	·755	50·7	77·3	62·4	326	506	421	87	55	75	N W	W b S	N W b W	0·81	0·90	5·15	...	Do.	Clear.	Cir. Str. 6.
11	·759	·714	·683	61·7	78·7	66·6	511	638	544	93	67	85	W S W	S W b W	S b W	0·15	0·87	0·40	...	Do.	Cir. Cum. Str. 9.	Clear, ft. aurora.
12	·470	·389	·457	70·4	87·6	75·6	659	776	670	90	62	78	W b S	W b S	S W b W	1·75	11·25	14·00	...	Cirr. Str. 4.	Cum. Str. 4.	Clear, sht. li'ng.
13	·700	·775	·929	58·3	66·2	51·1	412	317	264	85	49	68	N W	N W b W	N W b W	7·69	20·00	9·08	0·203	Cir. Str. 10.	Clear.	Do. ft. aur. lght.
14	·956	·987	·905	42·1	66·2	45·3	215	354	272	76	55	86	N E	S S E	S E	0·50	1·14	0·64	...	Clear, Frost.	Do.	Do.
15	·850	·714	·694	44·5	67·1	60·0	282	455	441	92	69	84	S E b E	S E b E	S	Inap.	1·35	3·14	...	Do.	Cir. Str. 4.	Cirr. Str. 8.
16	·651	·625	·723	62·3	73·4	48·5	499	628	332	89	78	97	S W	W b S	N E b N	1·00	2·77	6·51	0·566	Str. 10.	Do. 10.	Rain.
17	·765	·751	·656	51·0	60·9	54·2	350	416	400	90	79	93	N N E	E b S	N E b N	Inap.	2·25	0·11	0·683	Cirr. Str. 10.	Do. 4.	Rain.
18	·635	·715	·839	49·1	52·1	43·2	336	246	216	93	61	73	N E b N	N b E	N E b N	3·25	10·62	4·75	0·632	Rain.	Do. 2.	Clear.
19	30·040	30·005	30·086	38·4	51·7	36·0	189	238	182	76	61	78	N	N N E	N N W	0·90	0·72	0·22	...	Clear.	Cum. 2.	Do.
20	·140	29·989	29·939	34·2	60·0	48·7	204	293	281	95	56	80	W b N	S W b W	S W b W	0·24	0·22	0·83	...	Do.	Clear.	Cirr. Str. 6.
21	29·846	·754	·770	42·9	61·0	52·6	263	407	349	92	75	87	W	S W b W	S E b S	0·40	0·12	Inap.	Inapp.	Do.	Cir. Cum. Str.10	Do. 10.
22	·841	·844	·924	50·0	58·0	51·4	314	412	337	85	84	81	N E b E	N E b E	N E b E	Calm	Calm	Calm	Inapp.	Cirr. Str. 10.	Cir. Str. 4.	Cum. Str. 4.
23	30·075	30·155	30·161	46·8	67·4	46·4	303	455	303	93	69	93	N E b E	E b S	E S E	1·00	0·92	Inap.	...	Str. 10.	Str. 10.	Do. 4.
24	·132	·002	29·909	42·0	63·9	54·5	273	435	400	96	75	93	E	E b S	E S E	Inap.	1·10	Calm	...	Fog, a. m.	Cir. Str. 10.	Do. 10.
25	29·900	·788	·827	52·0	70·5	60·6	349	541	411	87	74	84	N E b E	S E	E	Calm	0·02	0·78	0·336	Cirr. Str. 10.	Do. 8.	Do. 8.
26	·496	·377	·335	61·2	69·0	66·0	483	640	605	89	92	94	S S E	S S W	S S W	5·12	0·78	0·42	0·656	Do. 8.	Rain.	Do. 8.
27	·436	·513	·720	53·1	61·0	46·7	372	383	262	89	71	80	N W b W	N W b W	N W b W	1·26	0·27	1·43	0·010	Str. 4.	Cirr. Str. 4.	Do. 6.
28	·958	·951	·972	40·1	56·0	42·5	210	274	213	79	60	85	N W b W	W b N	S W	1·21	Calm	Calm	...	Clear.	Clear.	Clear.
29	30·001	30 040	·885	32·0	68·0	46·6	192	422	282	96	62	86	W	S	S b E	Calm	2·14	0·14	...	Do. hoar frost.	Do.	Light Cirr. 4.
30	29·700	29·665	·773	50·8	66·1	55·8	349	440	450	93	68	99	S	S E	S E	2·21	13·55	6·24	0·233	Cir. Cum. Str. [3.	Cirr. Str. 8.	Rain.

Barometer ....
- Highest, the 23rd day .... 30·161
- Lowest, the 26th day .... 29·335
- Monthly Mean .... 29·832
- " Range .... 0·826

Thermometer
- Highest, the 12th day .... 87°·7
- Lowest, the 28th day .... 30°·4
- Monthly Mean .... 58°·55
- " Range .... 57°·3
- Mean Humidity .... ·903

Greatest Intensity of the Sun's Rays .... 126°·2
Lowest Point of Terrestrial Radiation .... 29°·3
Amount of Evaporation, 3·04 inches.

Rain fell on 12 days, amounting to 3·471 inches, and was accompanied by thunder on one day. Raining 42 hours. 29 minutes.
Most prevalent Wind, N.W.bW. Least prevalent Wind, E.
Most Windy Day, the 13th day; mean miles per hour, 12·25.
Least Windy Day, the 22nd; mean miles per hour, 0.00.
Aurora Borealis visible on 2 nights. Might have been seen on 12 nights.
Brilliant Meteor on the 11th day at 9·40 p.m. in S.E. passing from Algenib Pegasi to H Antini.
Meteor of moderate brightness on the 12th day at 9 p.m. in S.E. passing from E pise: accident: to B Aquarii.
The electrical state of the atmosphere has been marked by rather feeble intensity, increased during each fall of rain.
Ozone was in rather large quantity during the month.

Monthly Meteorological Register, Quebec, Canada East, August, 1855.

BY LIEUT. A. NOBLE, R.A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 *deg.* 49·2 *min. North; Longitude,* 71 *deg.* 16 *min. West. Elevation above the level of the Sea,—Feet.*

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Tension of Vapour.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°	°	°																	
1	29·836	29·874	26·876	29·862	60·3	71·2	64·8	65·4	0·338	0·380	0·374	0·364	66	51	63	60	W b S	E S E	E S E	7·2	13·9	17·2	...	...	
2	·903	·933	·792	·876	61·4	82·1	69·9	71·1	·430	·447	·570	·482	81	42	81	68	S	S	E	6·2	3·8	11·3	·055	...	
3	·784	·697	·606	·696	68·8	81·2	69·6	73·2	·578	·623	·608	·603	85	60	87	77	S	W	S E	9·3	11·3	10·0	·383	...	3rd. Thunder and lightning.
4	·467	·536	·622	·542	69·0	78·0	65·9	71·0	·625	·743	·475	·614	91	81	76	83	N W	N W	N N E	7·2	7·2	3·8	·072	...	
5	·601	·561	·508	·557	62·8	73·8	64·2	66 9	·436	·246	·377	·353	78	31	64	58	N W	N W	W	5·2	11·3	3·8	...	...	
6	·506	·556	·610	·557	58·5	75·0	61·1	64·9	·353	·478	·249	·360	74	56	47	59	N	N N W	N N W	8·0	8·0	8·0	...	...	
7	·709	·723	·802	·745	53·0	63·8	54·1	57·0	·246	·273	·227	·249	62	47	56	55	N N W	W	N N W	3·8	13·8	8·0	...	...	
8	·872	·801	·601	·757	49·4	68·9	59·3	59·2	·280	·265	·434	·326	81	39	88	69	S	S	S E	2·0	2·0	5·2	·396	...	
9	·386	·099	28·969	·151	63·8	61·5	63·8	63·0	·526	·486	·520	·511	91	91	90	91	S E	S E	Calm.	6·2	2·0	0·0	·792	...	
10	·070	·197	29·448	·38	58·7	61·1	55·3	58·4	·434	·336	·343	·371	90	64	80	78	W	W	Calm.	15·5	21·3	0·0	...	...	
11	·654	·797	·856	·769	52·7	63·5	58·2	58·1	·336	·373	·364	·358	86	65	77	76	S S E	S S E	S S E	5·2	3·8	6·2	...	...	
12	·879	·815	·682	·792	56·8	77·3	65·9	66·6	·401	·326	·299	·342	89	36	49	58	N E	N E	W	6·2	3·8	3·8	·851	...	
13	·680	·619	·638	·646	62·1	75·2	63·9	67·1	·294	·394	·317	·335	53	47	55	52	W	W	W	13·4	17·9	14·3	...	...	
14	·735	·785	·823	·781	56·1	66·6	56·9	59·9	·274	·263	·269	·269	63	42	60	53	S W	W	W	5·2	11·5	5·2	...	...	
15	·835	·683	·569	·696	50·9	69·1	66·6	62·2	·299	·375	·390	·355	82	55	61	66	S S W	Calm.	Calm.	2·0	0·0	0·0	1·485	...	15th and 16th. In 28 hours there fell 5·854 inch. of rain.
16	·479	·376	·363	·406	63·9	64·5	65·1	64·5	·506	·59	·606	·567	88	100	100	96	S W	W	W	2·0	2·0	3·8	4·369	...	
17	·346	·263	·448	·352	62·1	73·9	56·2	64·1	·518	·570	·303	·464	95	70	68	78	W	W	W N W	3·8	3·8	23·1	...	...	
18	·613	·665	·763	·680	53·0	62·2	54·3	56·5	·316	·283	·267	·289	80	52	65	66	N N W	W	N N W	12·4	19·7	12·9	·054	...	
19	·942	·935	·932	·936	46·9	65·2	56·9	56·3	·269	·271	·302	·281	83	44	66	64	N N W	W	W	10·0	13·9	25·4	...	...	
20	·933	·896	·883	·904	52·4	66·4	62·9	60·6	·310	·409	·381	·367	80	70	68	73	W	W	Calm.	6·2	8·0	0·0	...	...	
21	·815	·708	·698	·740	58·8	76·6	71·2	68·9	·413	·463	·496	·457	85	52	67	68	W	W	W	13·9	13·9	13·9	·075	...	
22	·739	·787	·692	·739	64·3	67·4	65·2	66 0	·550	·552	·508	·537	94	86	84	88	W N W	Calm.	W	16·0	0·0	5·2	·006	...	
23	·614	·446	·394	·485	63·9	71·6	63·2	66·2	·517	·551	·576	·548	89	74	100	88	E	E	W	5·2	3·8	2·0	·752	...	
24	·424	...	...	...	60·7	...	...	...	·505	...	...	...	97	...	...	...	N N W	...	N W	17·9	...	...	...	...	
25	·825	·861	·822	·836	47·6	66·1	58·2	57·3	·287	·310	·384	·327	89	52	81	74	N W	N W	N W	3·8	3·8	5·2	·132	...	
26	·676	·538	·907	·707	57·4	71·0	52·8	60·4	·395	·598	·229	·407	86	81	59	75	N W	N W	N N W	3·8	22·7	11·3	·567	...	
27	30·005	29·953	·907	·955	42·1	59·5	51·1	50·9	·200	·261	·267	·243	75	53	80	69	N W	N W	Calm.	6·2	6·2	0·0	...	...	
28	29·902	·802	·776	·827	46·8	61·9	52·4	53·7	·235	·235	·320	·293	74	43	82	70	Calm.	W	S S E	0·0	3·8	3·8	...	...	
29	·660	·433	·350	·481	47·2	73·2	60·1	60·2	·254	·405	·435	·365	79	51	85	72	Calm.	S W	W N W	0·0	12·4	10·0	·349	...	
30	·660	·842	·867	·790	46·3	53·9	45·0	48·4	·203	·185	·113	·167	66	45	33	48	N W	W N W	W b N	10·0	15·2	8·8	...	...	
31	30·012	·989	·960	·987	38·3	57·3	50·6	48·7	·152	·169	·174	·165	66	36	40	47	N N W	N W	W N W	8·0	8·8	3·8	...		
M	29·7046	29·6723	29·6721	29·6830	55·84	68·63	60·16	61·54	0·366	0·395	0·373	0·378	80	57	71	69				6·30	8·32	7·53	10·338		

Maximum Barometer, 6 a.m. on the 31st	30·012
Minimum Barometer, 10 p.m. on the 9th	28·969
Monthly Range	1·043
Monthly Mean	29·6830
Maximum Thermometer on the 2nd	85°0
Minimum Thermometer on the 31st	38·3
Monthly Range	46·7
Mean Maximum Thermometer	71·75
Mean Minimum Thermometer	51·8
Mean Daily Range	19 95

Mean Monthly Temperature	61·54
Greatest Daily Range of Thermometer on 29th	29·°3
Least Daily Range of Thermometer on 9th	5°·3
Warmest Day, 3rd. Mean Temperature	73·2
Coldest Day, 31st Mean Temperature	43·7
Climatic Difference	29·5

Possible to see Aurora on 12 Nights.
Aurora visible on 9 Nights.
Total quantity of Rain, 10·338 inches.
Rain fell on 15 days.

Monthly Meteorological Register, Quebec, Canada East, September, 1855.

BY LIEUT. A. NOBLE, F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude, 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea,—Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr.				Temperature of Air.				Tension of Vapour.				Humid'y of Air.				Direction of Wind.			Velocity of Wind.			Rain in Inch.	Snow in Inch.	REMARKS.
	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	MEAN.	6 A.M.	2 P.M.	10 P.M.	M'N	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.			
					°	°																			
1	29·741	29·590	29·491	29·607	49·3	54·3	57·4	53·8	0·319	0·375	0·464	0·386	92	90	100	94	Calm.	Calm.	N W	0·0	0·0	3·8	1·144	...	
2	·508	·563	·827	·633	60·0	62·0	52·2	58·1	·480	·363	·243	·362	95	67	61	74	W	N N W	N	3·8	7·2	11·3	...	...	
3	·874	·864	·916	·885	46·1	60·0	53·0	53·0	·224	·283	·284	·264	74	57	72	68	Calm.	E N E	E N E	0·0	5·2	6·2	...	...	
4	·997	·988	30·034	30·006	48·0	65·4	54·1	55·8	·273	·250	·315	·279	82	41	77	67	Calm.	E N E	W S W	0·0	5·2	7·2	...	...	
5	30·083	30·011	·005	·033	47·6	69·3	58·0	58·3	·282	·337	·361	·327	87	49	77	71	S W	W S W	S S W	3·8	6·2	5·2	...	...	
6	·038	·011	·029	·026	57·0	66·9	57·2	60·4	·412	·430	·426	·423	91	67	93	84	W S W	E N E	E N E	5·2	2·0	3·8	...	...	
7	29·974	29·803	29·678	29·818	52·2	67·4	63·8	61·1	·355	·474	·488	·439	93	73	85	84	Calm.	W S W	N W	0·0	3·8	12·4	...	...	
8	·649	·577	·528	·885	60·3	77·7	68·0	68·7	·416	·419	·593	·476	81	45	90	72	W	W S W	W S W	3·8	11·5	2·0	·052	...	
9	·475	·443	·597	·505	66·4	74·9	61·9	67·7	·608	·390	·315	·438	97	47	58	67	W S W	W N W	N W	8·8	19·7	8·0	...	...	
10	·661	·661	·682	·668	56·0	69·8	60·1	62·0	·298	·331	·370	·333	68	47	72	62	W N W	W	W S W	7·2	7·2	3·8	...	...	
11	·697	·659	·633	·663	56·1	75·0	67·4	66·2	·356	·479	·508	·448	81	57	78	72	W S W	W S W	Calm.	8·0	8·8	0·0	·066	...	
12	·513	·416	·385	·438	64·4	75·9	52·9	64·4	·533	·674	·371	·526	94	77	94	88	Calm.	W S W	E	0·0	8·8	10·0	·402	...	
13	·499	·654	·888	·680	58·2	62·8	50·1	57·0	·276	·237	·200	·238	58	42	56	52	N W	W	N N W	11·3	17·9	16·0	...	...	
14	30·026	·960	·886	·957	45·0	56·2	46·1	49·1	·248	·258	·244	·250	84	59	80	74	Calm.	N	W N W	0·0	2·0	2·0	...	...	
15	29·857	·749	·650	·752	47·5	64·9	60·4	57·6	·227	·393	·385	·335	70	66	77	71	Calm.	W	S W	0·0	5·2	8·0	...	...	
16	·592	·624	·660	·625	59·5	53·9	49·0	54·1	·388	·344	·279	·337	78	85	81	81	W S W	E N E	E N E	7·2	16·0	16·3	·158	...	
17	·734	·717	·570	·674	52·7	56·3	48·3	52·4	·295	·293	·301	·296	76	66	90	77	W S W	W b N	NWbW	3·8	7·2	8·8	·079	...	
18	·515	·603	·718	·612	48·3	47·2	38·9	44·8	·195	·223	·108	·175	61	95	36	64	N W	N W	N W	6·2	12·4	10·0	...	...	
19	·847	·950	30·034	·944	36·1	47·2	37·9	40·4	·126	·144	·147	·139	59	45	65	56	N N W	N N W	N N W	22·7	17·9	7·2	...	...	
20	30·034	·844	29·777	·885	35·0	54·3	46·4	45·0	·165	·270	·258	·231	81	84	88	84	W	W S W	W S W	3·8	17·6	8·8	...	...	
21	29·779	·697	·711	·729	41·0	60·5	53·1	51·5	·234	·225	·296	·253	92	44	75	70	W	S W	E	3·0	13·4	11·3	·019	...	21st. At 1 p.m. a halo 45° in diameter round the sun.
22	·770	·846	·937	·851	47·9	48·5	46·2	47·5	·281	·277	·278	·279	86	83	90	86	E	E N E	E N E	16·0	16·0	13·9	...	...	
23	30·045	30·080	30·100	30·075	46·4	54·3	50·5	50·4	·265	·271	·320	·285	85	66	89	80	E N E	S E	E	3·8	3·8	8·8	...	...	
24	·141	·047	·011	·066	46·6	59·3	52·7	52·9	·281	·317	·330	·309	90	64	85	80	Calm.	Calm.	Calm.	0·0	0·0	0·0	·026	...	
25	29·936	29·793	29·700	29·810	52·7	65·4	54·8	57·6	·351	·310	·388	·350	90	51	92	78	Calm.	W S W	E	0·0	6·2	2·0	...	...	
26	·621	·384	·289	·398	53·0	65·7	62·5	60·4	·374	·407	·533	·438	95	66	96	86	E N E	E	Calm.	3·8	3·8	0·0	11·84	...	
27	·303	·389	·590	·427	49·6	61·9	48·6	53·4	·321	·329	·208	·286	92	61	62	72	S W	N W	W b N	8·8	10·0	5·2	...	...	
28	·735	·800	·926	·820	41·2	55·2	44·7	47·0	·174	·176	·224	·191	67	41	70	59	N W	N W	N W	6·2	13·4	11·3	...	...	
29	30·006	·935	·894	·945	38·6	58·4	49·5	48·8	·188	·215	·305	·236	80	45	88	71	W S W	W	E	5·2	2·0	2·0	...	...	
30	...	·712	...	...	...	60·8	...	...	...	·276	...	...	...	53	...	...	...	E N E	...	...	16·0	...	·594	...	
M	29·777	29·747	29·695	29·739	50·44	61·74	53·30	55.16	0·308	0·327	0·329	·321	82	61	79	74				4·91	8 ·64	7·08	3·724		

Maximum Barometer, 6 a.m. on the 24th	30·141
Minimum Barometer, 6 a.m. on the 27th	29·303
Monthly Range	·838
Monthly Mean	...
Maximum Thermometer on the 8th	81°·3
Minimum Thermometer on the 19th	34·7
Monthly Range	46·6
Mean Maximum Thermometer	63·93
Mean Minimum Thermometer	46·79
Mean Daily Range	17·14

Mean Monthly Temperature	55·15
Greatest Daily Range of Temperature on the 12th	26·3
Least Daily Range of Temperature on the 22nd	5·4
Warmest Day, 8th. Mean Temperature	68·7
Coldest Day, 19th. Mean Temperature	40·4
Climatic Difference	28·3

Possible to see Aurora on 10 nights. Aurora visible on 8 nights.
Total quantity of Rain, 3·724 inches.
Rain fell on 10 days.
No Snow fell.

The Canadian Journal.

TORONTO, DECEMBER, 1855.

CANADIAN INSTITUTE.

SESSION 1855-56.

First Ordinary Meeting—Saturday, December 1st, 1855.

The minutes of the previous meeting (Saturday, 7th July, 1855), having been read and confirmed, the following gentlemen, who had been provisionally elected members of the Institute by the Council during the recess, were duly elected :—

George Morphy	Toronto.
T. G. Ridout	"
W. C. Evans	Montreal.
Rev. J. G. Geddes	Hamilton.
Sir George Simpson	Lachine.
James Webster	Guelph.
W. M. Wilson	Simcoe.
James Crawford	Brockville.
William Kingsford	Toronto.
William Hodgins	Hamilton.
Colonel Baron de Rottenburg	Toronto.
Dr. F. Russell	"
Dr. A. Jukes	St. Cathcrines.
Charles Jones	Toronto.
Alexander Murray	Woodstock.
Captain Beecher, R.N	London, England.
Hon. Robert Spence	Toronto.
Archibald Carlyle	Orillia.
John Wilson, M.P.P.	London, C.W.
S. F. Holcomb	Hamilton.
Romeo H. Stephens	Montreal.
Dr. Thomas Cowdry	Cobourg.
Rev. A. C. Geikie	Toronto.
William Hind	"
Geoffry B. Hall	Nanticoke.
William Mercer	Simcoe.
L. A. H. Latour	Montreal.
W. Coverton	Simcoe.
Professor Young	Toronto.
W. M. Matheson	"
Larratt W. Smith, D.C.L.	"
A. Sullivan	"
Thomas W. Lawford	Lendon, C.W.
John McKinnon	Ottawa.
John Patton	Toronto.
Professor Kingston	"
Moses H. Perley	St. John's, N.B.
W. McMaster	Toronto.
Amos Bostwick	"
George Beatty	"
Andrew Russell	"
John Gibbs Ridout (jun. mem.)	"
Rev. W. McMurray, D.D	Dundas.

Professor Croft read a Paper "On the Hydrate of Hydro-Sulphuric Acid."

Professor Wilson read a Paper "On Displacement and Extinction among the Primæval Races of Man."

Second Ordinary Meeting—Saturday, December 8th, 1855.

The names of the following candidates for membership were read :—

John W. Dawson, F.G.S	Montreal.
Rev. W. A. Johnson	Toronto.
Rev. John Taylor	"
Arthur Carter (jun. mem.)	"
Donough O'Brien, do.	"

The nominations for the Office-bearers of the ensuing year were then made :—

	No. of Nominations.		
President	One		
First Vice President	Five.	Corresponding Secretary.	Two.
Second Vice President	Five.	Librarian	Three.
Treasurer	Three.	Curator	Three.
Recording Secretary	Two.	Council	Thirty-eight.

The Indenture relating to the union of the Toronto Athenæum with the Canadian Institute, was read, submitted to the meeting, and approved of.

The following Donations were announced :—

From the Honourable P. B. de Blaquière :

Journal of the Legislative Council, 1848.
Do. do. Vol. VIII., 2nd Session of Third Parliament, 1849, Part I.
Do. do. Vol. IX., Third Session of Third Parliament, 1850
Do. French.
Appendices, No. I. & No. II., Vol. IX., 1850.
Journal of the Legislative Council, 1851.
Do. do. Vol. XI.
Legislative Council Sessional Papers, No. I., Vol. VIII., 2nd Session 3rd Parliament, 1849.
Do. French.
Do. No. II., French.
Do. No. III.
Canada Legislative Council Sessional Papers :—
No. 4, Vol. XI., 1st Sess. 4th Parl., 1852–3.
5, do. do.
6, do. do.
7, do. do.
8, do. do.
9, do. do.
Statutes of Canada, Vol. III., 1851.
Do. 1852–3, Part I.,
Do. 1852–3, 4th Parliament, 16th Victoria.
Do. 1854–5, Part I.
Do. do. " II.
Census of the Canadas, 1851–2, Vol. I.
Trade and Navigation, 1850.
Edicts et Ordonnances, Vol. II.
Total (half-bound Books.)
*Return Plank or Macadamized Roads, &c. 1851.
*Annual Report of Inspectors of Provincial Penitentiary.
*Reports of Commissioners on Discipline and Management of the Provincial Penitentiary.
*Reports of Commissioners on Public Works, 1850.
*Do. 1851.
*Summary of Proceedings of the Legislative Assembly, 1st Session, 5th Parliament, 1854.

Those marked thus (*) are Pamphlets.

*Prize Essay, Alex. Morris.
*Canada, by Hon. F. Hincks.
*Reports 1st and 2nd, Inquiry into Public Income and Expenditure.
*Report of Inquiry into Public Departments.
*Political Catechism, in French.
*Public Accounts for the year 1852.
*Annual Report of the Post Master General, for the Year ending 5th of April, 1852.
*Report of Commissioners of Public Works, 1851.
*Report of Select Committee on Charges against tho late Ministry, 1854.
*Seignorial Tenure, J. C. Tache.
*Public Accounts, 1853.
*Report on the Riot at Chalmers' Church.
*Report on Accidents on Great Western Railway.
*Second Report on Public Accounts, 1853.
*Report on the Management of Public Lands.
*Report on Agricultural Societies in Lower Canada.
*Documents—Bureau of Agriculture.
*Journal of the Transactions of the Board of Agricultnae of Upper Canada, No. II., Vol. I.
*Do., No. III., Vol. I.
*Roman Catholic Bishop of Toronto, &c., on Separate Common Schools.
*Seven Letters on the Common School System.
*Correspondence on Separate Schools.
*Annual Report of the Normal, Model, aud Common Schools, Upper Canada, 1851.
*Do., 1853.
*Report on Ice-Bridge at Quebec.
*Heat and Ventilation, &c.
*Philosophie des Chemins de Fer.
*Report on tho St. Lawrence and Ottawa Junction Railway.
*Report on Organizing the Militia.
*The Upper Canada Journal.
*Report on Cause of Fire in Parliament Buildings, 1854.
*Report on North Shore Railway.
*Report on Admiralty Tariff of Fees.
*Return—Contracts to the Junction Canal.
" Schools in the Ottawa District.
" connected with the Grand Truuk Railroad.
" Montreal Harbour.
*Papers—Late Welland Canal Company.
*Statement of Expenditure of £30,000 in aid of Settling Vacant Lands in Lower Canada.
*County Lotbinere Election Committee.
*Report—Catalogue of Books in Library of Legislative Assembly.
*Orders of the Court of Chancery.
*Despatches—referring to Seignoireal Tenure in Lower Canada.
*Estimate of Expenses of Civil Government, 1853.
*Loose Sheets—The Statutes of Canada.
*Logan's Geological Survey—Report of Progress, 1848-49.
*Do. 1850-51.
*Do. 1851-52.

From the Rev. W. Agar Adamson, D.C.L.:—

Minutes of the Committee of Council on Education, with Appendices and Plans of School Houses, 1845. Vol. II.
Do. do. do. England and Wales, Schools of Parochial Unions, 1847–8–9
Do. do. 1848–9, Correspondence, &c.
Do. do. Correspondence, Tabulated Satements of Grants &c,, 1848–49–50, Vol. I.
Do. do. Vol. II.
Do. do. Financial Statements, &c., and Reports by Her Majesty's Inspectors of Schools, 1850–51.
Do. do. Schools of Parochial Unions in England and Wales, &c., 1850–51–52.
Do. do. Correspondence, &c,, 1851–2.
Do. do. do. 1852–3.

From Lieut.-Col, J. H. Lefroy, R.A. :—

Italian Irrigation, by Capt. R. Baird Smith, F.R.S., Vols. I. & II.
Magnetical and Meteorological Observations made at Lake Athabasca, &c., by Capt. J. H. Lefroy, R.A.

From the Hon. J. M. Brodhead, of Washington, through A. H. Armour, Toronto :—

Patent Office Reports, 1854, Agriculture.
United States Coast Survey, 1854. Report of the Superintendent.
Explorations and Surveys for a Railroad from the Mississippi River to the Pacific Ocean.

The thanks of the Institute were ordered to be transmitted to the donors for their valuable donations.

A Paper was read by Professor Chapman, "On a Convenient Method of Indicating in Crystal Combinations the Relative Positions and Degrees of Development of the Included Forms."

Annual General Meeting, Saturday, December 15th, 1855.

The Annual Report was read and adopted.

ANNUAL REPORT OF THE COUNCIL, 1855.

The Council of the Canadian Institute have the honour to submit to the Members, the following Report of the operations of the past Session, and of the proceedings adopted by the Council with a view to the still more effective furtherance of the objects for which the Institute has been founded.

The Council have much satisfaction in reporting, that the progress of the Institute, as indicated by the number of its members, continues to furnish gratifying evidence of the increasing hold it is acquiring on the Province. Last year the Council drew attention to the fact that the members—who numbered only 112 at the close of 1851, the first year of incorporation—had increased, in all, to 333, and since then we have to report a further addition of 104 members, which, after deducting eighteen, resigned or deceased, make the present number of members constituting the Canadian Institute, 419, exclusive of those of the Athenæum.

In the last Annual Report, the Council referred to the anticipated amalgamation of the Athenæum with the Canadian Institute. This highly desirable union has since been happily completed. A permissive Act, giving the Athenæum full power to effect a junction with the Institute, was passed during the last Session of the Provincial Parliament, and since then the requisite deeds have been executed, and the valuable Library and Collection of Minerals have been transferred to the Canadian Institute. The importance of the addition thus acquired to the Library can scarcely be too highly estimated, as it consists, in all, of 800 volumes, including the Transactions of various of the leading Scientific and Literary Societies of Great Britain, as well as other works of a strictly scientific character. The Council recommend to their successors the duty of completing and continuing the valuable serial publications thus acquired; and of cultivating that intercourse with the Scientific Societies not only of Britain, but of Europe, which may secure an interchange of a class of publications so beneficial to the Institute.

The Minerals added to the Museum, in consequence of this amalgamation, it is believed will also prove a valuable addition to the collections of the Institute; but the difficulties attendant on their removal, and the very brief period that has elapsed since the completion of the requisite legal deeds for effecting the union with the Athenæum, have prevented a minute examination of them; and the Council would suggest the appointment of a small Committee, to superintend their classification, and to report on their nature and value.

The duty will devolve on the new Council to adopt means for carrying out, in the most liberal spirit, the conditions annexed to the acquisition of the Library of the Athenæum, whereby the Institute becomes bound to afford the public free access to the joint Library, under such restrictions as may be found requisite for its safety. In thus establishing a Library

of Reference, specially designed to afford facilities for scientific and literary research, the Council feel assured that the members will hail it as an additional step in furtherance of the objects of the Institute, rather than as a condition detracting in any degree from the value of the increase made to the collections.

The Council avail themselves of this opportunity to record the obligations under which they, as well as all the members of the Institute, are laid to Oliver Mowat, Esq., one of their number, by whom all the requisite legal deeds, for effecting the union of the Athenæum with the Canadian Institute, have been gratuitously prepared and executed.

The additions made to the Library, by purchase, during the past year, include some works of value, among which the Council have been indebted to Lieutenant-Colonel Lefroy's good services, for enabling them to acquire seventeen volumes of the Philosophical Transactions, wanted to complete the Library set. But the Council have been induced to curtail their expenditure, in this and other respects, in anticipation of the inevitable outlay attendant on the resumption by the Government of the rooms provided for the use of the Institute in Government House.

The following List comprises the additions which have been made to the Library, by purchase, during the past year:—

Books Purchased for the Library.

	Vols.
Hand Book of Chemistry, by Leopold Gmelin, Professor of Chemistry in the University of Heidelberg, &c., &c., Vols. 1 to 8	8
Physiological Chemistry, by Prof. C. G. Lehman, translated by George E. Day, M.D., F.R.S., Vols. 1 & 2	2
Life of the Hon. Henry Cavendish, including abstracts of his more important scientific Papers, and a critical inquiry into the claims of all alleged discoveries of the composition of Water; by George Wilson, M.D., F.R.S.E., Lecturer on Chemistry, Edinburgh	1
Elements of Chemical and Physical Geology, by Gustav Bischof, Ph. D., Prof. of Chemistry and Technology in the University of Bonn; translated from the manuscript of the author by Benjamin H. Paul, F.C.S., & J. Drummond, M.D., Vol. 1	1
Life of John Dalton, by Wm. C. Henry, M.D., F.R.S.	1
The Planetary System, its Order and Physical Structure, by J. P. Nicholl, LL.D., Prof. of Astronomy in the University of Glasgow, &c.	1
Encyclopædia Metropolitana, or System of Universal Knowledge. Third edition enlarged; second division applied sciences: Photography	1
Atlas of Physiological Chemistry, consisting of microscopic Figures, by Dr. Otto Funke, a Supplement to Lehman's Physiological Chemistry	1
A Pamphlet accompanying do., by the same author	1
Report of Sixth Anniversary Meeting of the Cavendish So.	1
London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science, January, 1855	1
February, "	1
March, "	1
April, "	1
May, "	1
June, "	1
The Ethnological Journal—a Magazine of Ethnographical and Antiquarian Science. Edited by Luke Burke, Esq. New series, published quarterly.—No. 1, Jan., 1854	1
Philosophical Transactions for the years 1817–18–21–22–23–24–25, two Vols.–26, two Vols.–27–28–29–30–31–32 and 33—total Vols	17

The following books have been bound, and added to the Library, from the Periodicals received during previous years:

	Vols.	
Journal of the Franklin Institute, 1851	2	
" " 1852	2	
Athenæum, 1840	1	Gift from Lt. Col. Lefroy.
" 1841	1	
Athenæum, 1851	1	
" 1853	1	
Transactions of the Board of Agriculture of Upper Canada, 1853	1	
Journal of Education, Upper Canada, 1853	1	
The Artizan, 1851	1	
" 1852	1	
" 1853	1	
London Quarterly Review, 1852	1	
" " 1853	1	
North British Review, 1852–3	1	
Westminster, " 1852	1	
Edinburgh, " 1852	1	
" " 1853	1	
Blackwood, July to December, 1852	1	
Civil Engineer and Architect's Journal, 1852	1	
Anglo American, Vol. II., III., IV., V.	4	
Appleton's Mechanics' Magazine, 1851	1	
" " " 1852	1	
" " " 1853	1	
Art Journal, 1853	1	
" 1854	1	
Blackwood's Magazine, 1854	2	
Westminster, 1854	1	
London Quarterly, 1854	1	
Edinburgh, Review, 1854	1	
Illustrated London News, 1853	2	
" " 1854	2	
Journal of the Franklin Institute, 1853	2	
" " Society of Arts, London, 1852–3.	1	
Civil Engineer and Architects' Journal, 1853, Vol. XVI.	1	
Journal of Education, 1854	1	

The Council have great pleasure in acknowledging the liberality with which contributions continue to be made to the Library; and they feel assured that nothing is wanted but a permanent building, with suitable accommodation for the adequate display of the collections, to secure for the Institute a Library and Museum, alike creditable to itself, and of practical benefit in advancing the cause of science in the Province. The following are the donations which have been received since last report:—

Donations to the Library.

	Vols.	
The Geology of the Island of Arran, by A. C. Ramsey	1	A. H. Armour.
Handbook for Field Service, edited by Captain Lefroy, Royal Artillery	1	Capt. Lefroy.
*Report of the Comrs. of Public Works for the years 1853 and 1855	1	Hon. W. B. Robinson.
*Return relating to Judicial Officers in L. Ca.	1	Thos. Henning.
*Titles & Documents relating to the Seigniorial Tenure, in return to an address of the Legislative Assembly, 1851	1	
*Edicts, Ordinances, Declarations, and Decrees relative to the Seigniorial Tenure, required by an address of the Legis. Assem., 1851	1	
*Relation abrégée de quelques Missions des Pères de la Comp. de Jesus dans la Nouvelle France	1	
Transactions of the Literary and Historical Society of Quebec, Vols. I. & II.	2	A. E. Meredith.
Annual Report of the Normal, Model, and Grammar Schools in U.C., year 1853	1	Dep't of Pub. Instruction, U.C.

From Mr. Bohn, per A. H. Armour:—

Cowper's Works, Vol. IV.	1	Stand. Library.
" " Vols. V. & VI.	2	
Hungary, its History and Revolutions	1	
History of Russia from the earliest Period	1	
Locke's Philosophical Works, Vol. II.	1	

Those marked thus (*) are Pamphlets.

Defoe's Works, edited by Sir W. Scott, Vol. I.	1	British Classics.
" " Vol. II.	1	
Gibbon's Roman Empire, Vols. IV. & V......	2	
Prior's Life of Burke..............................	1	
Burke's Works—Vindication of Nature, &c..	1	
The Elegies of Propertius, &c..................	1	Classical Libr'y.
The Geography of Strabo, Vol. I...............	1	
Xenophon's Anabasis..............................	1	
Logic or Science of Inference..................	1	Illus. Library.
India, Pictorial, Descriptive and Historical...	1	
Nicolini's History of the Jesuits...............	1	Phil. Library.
Ordericus Vitalis—Ecclesiastical History.....	1	Antiq. Library.
Matthew Paris's English Chronicle............	1	
Lamb's Specimens of English Dramatic Poets	1	
Marco Polo's Travels..............................	1	
Florence of Worcester's Chronicle............	1	
Ennemoser's History of Magic, in 2 Vols.	2	Sci. Library.
The Works of Philo Judæus, Vol. 1	1	Eccles. Library.
Lives of the Queens of Eng. before the Conq'st.	1	Blanchard & Lea, Philadel'a.
The American Almanack, 1855....................	1	
Meteorological Observations made at the Hon. E. India Company's Magnectical Observatory at Madras—years, 1846–1850..................	1	Hon. E. I. Com.
Compendium of United States Census, 1850....	1	Hn. J.M. Broadhead, per A. H. Armour.
Penal Codes of Europe, by H. S. Sandford......	1	Hon. J. M. Broadhead, per A. H. Armour.
Red River of Louisiana, by Lieut. Marcy.......	1	
Maps accompanying do..............................	1	
Cruise of Dolphin, by Lieut. Lee..................	1	
Maps accompanying do..............................	1	
Exploration of the Valley of the Amazon, by Lieut. Gibbon	1	
Maps accompanying do..............................	1	
Mexican Claims, Report of Select Committee...	1	
Sickness and Mortality on Board of Emigrant Ships—Report of Select Committee............	1	
Railroad to the Pacific, &c..........................	1	A. H. Armour.
Britania Depicta, by John Owen, 17th Cent'y.	1	E. C. Hancock.
The Case of the Black Warrior.....................	1	Hon. J. M. Broadhead, per A. H. Armour.
Report of an Expedition down the Zuni and Colorado Rivers, by Capt. Sitgraves............	1	
*Montreal and the Ottawa, by T. C. Keefer......	1	A. H. Armour.
Foster & Whitney's Report on the Geology of the Lake Superior land district. Part II.—The Iron district, with Map......................	1	Hon. J. M. Broadhead, per A. H. Armour.
The Constitution of the United States............	1	
Patent Office Reports, 1852, part II., agricult'e	1	
" 1853, " "	1	
" 1849–50, "	1	
" 1849–50, mechanics	1	
*Charter and By-Laws of Toronto Exchange....	1	
The Mechanical Inventions of James Watt.—Muirhead. London, John Murray—in 3 Vols.	3	G. Wilson, N.Y. per A. Brunel.
*Documents submitted by the Bureau of Agriculture to the Legislature of Canada, 1851...	1	Bureau of Agriculture.
Lardner's Natural Philosophy, Astronomy, &c.	1	Prof. Hind.
*The Roman Law—A Lecture, by F. W. Torrance, Esq.	1	A. Morris.
*Boston Journal of Natural History, vol. iv. p. 1.	1	By the Society, per G. P. Ure.
Do. do. " 2.	1	
Do. do. " 3.	1	
And the Printed Sheets in continuation.........		
Canadian Agriculturist, 1854, Vol. VI.	1	Exchange by So.
Espy's Second Report on Meteorology	1	Hon. J. M. Brodhead, per A. H. Armour.
United States Coast Survey, 1853	1	
Maps to accompany do., 1854	1	
Stansbury's Expedition to the Great Salt Lake	1	
Maps to Accompany do..............................	1	
Patent Office Report, Part II., 1853	1	
*Official Army Register, United States, 1855 ...	1	
*Navy Register, United States, 1855...............	1	
Census of Canada, 1851–2...........................	2	A. H. Armour.
*Report of Select Committee on Geological Survey of Canada	1	Hon. W. B. Robinson.
*Annual Report, Normal, Model, &c. Schools, 1852	1	Hon. J. H. Cameron.
*Report of Committee on Accidents, Great Western Railway of Canada, Nov. 3, 1854.........	1	
*Report on the Caughnawaga Canal, and Improvements of the Rapids of the St. Lawrence	1	
Quarterly Journal of the Geological Society, May, 1854	1	From the Soc.
Do. August, 1854..	1	
Do. November, 1854	1	
Do. February, 1851	1	
Journal of the Asiatic Society of Great Britain and Ireland, Vol. XVI., Part I....................	1	From the Soc.
Catalogue of Manuscripts in Arabic, &c..........	1	
Essay on Architecture of the Hindoos, by Ráne Ráz	1	
Address of the Earl of Ellesmere at the Anniversary Meeting of the Royal Geographical Society, May 22, 1854	1	
Journal of the Transactions of the Board of Agriculture of Upper Canada, No. I. Vol. I. April, 1855	2	Per Board.
*Report of Dredging Lake St. Peter, River St. Lawrence Improvement, with Chart, Thomas Keefer, Esq..	1	Hon. W. B. Robinson.
Documents relating to the Colonial History of New York, Vol. V.	1	The Regents.
Bombay Magnetical and Meteorological Observations, 1849.		E. I. Company.
Do. 1851.	1	
*Geological Survey of Canada, Report of Progress, Year 1852–3, W R. Logan.........	1	Hon. W. B. Robinson.
*Preliminary Report, Secretary to the Executive Commissioners of Canada in connection with World's Exposition, Paris, 1855. T. C. Tache.		
*Second Report of Standing Committee on Public Accounts...	1	
*Statement of Sums expended out of £80,000, granted for Aiding the Settling of Vacant Land in Lower Canada	1	
*Report of Commissioners on Public Works, 1852 and 1853	1	
*Report on Caughnawaga Canal	1	
Report on Trade and Navigation	1	
Railway Map of Upper Canada......................	2	
*Sixteenth Annual Report of the Regents of the University of the State of New York, March, 1855	1	The Regents.
*Annual Report of the Trustees of the State Library of the State of New York, March, 1855	1	
*Twenty-Seventh Annual Report of the Natural History Society of Montreal, May 18, 1855...		
Journal of the Board of Agriculture of Upper Canada, No. II., Vol. I., July, 1855		Board.
*Outlines of Flemish Husbandry, applicable to the Improvement of Agriculture in Canada...	2	Hon. W. B. Robinson.
*Hogan's Essay..	2	
*Return to an Address from the Legislative Assembly for Copy of certain Correspondence relative to Montreal Harbor..........................	1	Hon. W. B. Robinson.
*Summary of the Proceedings of the Legislative Assembly of Canada (1st Session of the 5th Parliament, 1854-55................................	1	
*Report of the New York State Cabinet of Natural History..	1	Dr. Beeks, per C. Jones.
*Report on the Alms House, Albany, State of New York, 1853.......................................	1	
*Report on the Public Schools of Albany.........	1	
*Sixth Annual Report of the Albany Penitentiary, 1855..	1	
*Report of the Directors of Northern Railway, July 16th, 1855.......................................	1	From Board.
Report of the Commissioners of Patents for the year 1854, Arts and Manufactures, Vol. II., Illustrations..	1	United States Patent Office.

Journal of the Royal Geographical Society, with Maps and Illustrations, Vol. 24, 1854	1	From the Societies.
Quarterly Journal of the Royal Geological Society, Vol. XI., Part 2, No. 42, May, 1855	1	
Map of the Province of Canada and the Lower Colonies, showing the Connection by Steam Navigation with the United States and with Britain, by the Route of the Great Salt Lakes, &c., prepared for Commissioners of Paris Exhibition, by Thomas Keefer, C. E.	1	Author, per Dr. Chewett.
Mercator's Projection, &c., by the same author, for the Commissioners	1	
Report of a Geological Survey of Winsconsin, Iowa, and Minnesota, and incidentally of a portion of Nebraska Territory, made by instructions from the United States Treasury Department, by David Dale Owen, United States Geologist	1	Hon. J. M. Brodhead.
Illustrations of ditto	1	
*Report of the Niagara Railway Suspension Bridge	1	J. M. Street.
*Report of the Proceedings of Select Committee on Charges against the late Administration	1	From Department, Quebec.
*T. C. Tache's Report on Canada, for the Commissioners of Paris Exhibition	1	
*Return for Copies of Documents relative to the Construction of Lighthouses and Piers below Quebec, and relating to Tenders and Contract for Tug Boats plying on the St. Lawrence below Quebec	1	
*The American Journal of Insanity, Vol. XII., No. 2	1	Exchange.
*Recherches Sur Les Eaux Minérales du Canada, par M. T. Sterry Hunt, de la Commission Géologique du Canada	3	Author.
Journal and Transactions of the Board of Agriculture of Upper Canada, No. 3, Vol. I., Oct. 1855	2	Board.
A Descriptive Catalogue of the London Trades Tavern and Coffee House Tokens, Current in the 17th century, presented to the London, England, Corporation Library, by Henry Buy Hanbury Beaufoy	1	From the Corporation Library, London, England, per A. H. Armour.
Documents relating to the Colonial History of the State of New York, Paris Documents, 1631-1744, Vol. IX	1	Regents of the University, State of New York.
Italian Navigation—Report on the Agricultural Canals of Piedmont and Lombardy, addressed to the Hon. E. I. Com., by Capt. R. Baird Smith, F.G.S., &c. Vols. 1 and 2	2	From Lieut.-Col. Lefroy, R.A.
Patent Office Reports, 1854, Agriculture.	1	Hon. J. M. Brodhead, per A. H. Armour.
Minutes of the Committee of Council on Education, with Appendices and Plans of School Houses, 1839–40	1	Rev. W. Agar Adamson, D.C.L
Do. do. 1844, Vol. I.	1	
Do. do. 1845, Vol. I.	1	

Minutes of the Committee of Council on Education, with Appendices and Plans of School Houses, 1845 Vol. II.	1	Rev. W. Agar Adamson, D.C.L.
Do. do. England and Wales,	1	
Schools of Parochial Unions, 1847–8–9	1	
Do. do. 1848-9, Correspondence, &c.		
Do. do. Correspondence, Tabulated Statements of Grants, &c., 1848–49–50, Vol. I.	1	
Do. do. do. Vol. II.	1	
Do. do. Financial Statements, &c., and Reports by Her Majesty's Inspectors of Schools, 1850-51	1	
Do. do. Schools of Parochial Unions in England and Wales, &c., 1850–51–52	1	
Do. do. Correspondence, &c. 1851–2.	1	
Do. do. do. 1852–3.	1	
Total	12	

Journal of the Legislative Council, 1848	1	Hon. P. de Blaquière.
Do. do. Vol. VIII., 2nd Session of Third Parliament, 1849, Part I.	2	
Do. do. Vol. IX., Third Session of Third Parliament, 1850	1	
Do. French	1	
Appendices, No. I. & No. II., Vol. IX., 1850	2	
Journal of the Legislative Council, 1851	1	
Do. do. Vol. XI.	1	
Legislative Council Sessional Papers, No. I.,	1	
Vol. VIII., 2nd Session 3rd Parliament, 1849.	1	
Do. French	1	
Do., No. II., French	2	
Do., No. III.	2	
Canada Legislative Council Sessional Papers:— No. 4, Vol. XI., 1st Sess. 4th Parl., 1852–3.	1	
5, do. do.	1	
6, do. do.	1	
7, do. do.	1	
8, do. do.	1	
9, do. do.	1	
Statutes of Canada, Vol. III., 1851	2	
Do. 1852–3, Part I.,	1	
Do. 1852–3, 4th Parliament, 16th Victoria	1	
Do. 1854–5, Part I	3	
Do. do. " II	3	
Census of the Canadas, 1851-2, Vol. I.	1	
Trade and Navigation, 1850	1	
Edicts et Ordonnances, Vol. II.	1	
Total (half-bound Books)	34	

*Return Plank or Macadamized Roads, &c. 185	1	Hon. P. de Blaquière.
*Annual Report of Inspectors of Provincial Penitentiary	1	
*Reports of Commissioners on Discipline and Management of the Provincial Penitentiary.	1	
*Reports of Commissioners on Public Works, 1850	1	
*Do. 1851	1	
*Summary of Proceedings of the Legislative Assembly, 1st Session, 5th Parliament, 1854	1	
*Prize Essay, Alex. Morris	1	
*Canada, by Hon. F. Hincks	1	
*Reports 1st and 2nd, Inquiry into Public Income and Expenditure	1	
*Report of Inquiry into Public Departments	1	
*Political Catechism, in French	1	
*Public Accounts for the year 1852	1	
*Annual Report of the Post Master General, for the Year ending 5th of April, 1852	1	
*Report Commissioners of Public Works, 1851.	1	
*Report of Select Committee on Charges against the late Ministry, 1854	1	
*Seignorial Tenure, J. C. Tache	1	
*Public Accounts, 1853	1	
*Report on the Riot at Chalmers' Church	1	
*Report on Accidents on Great Western Railway.	1	
*Second Report on Public Accounts, 1853	1	
*Report on the Management of Public Lands	1	
*Report on Agricultural Societies in L. Canada.	1	
*Documents—Bureau of Agriculture	1	
*Journal of the Transactions of the Board of Agriculture of Upper Canada, No. II., Vol. I.	1	
*Do. No. III., Vol. I.	1	
*Roman Catholic Bishop of Toronto, &c., on Separate Common Schools	1	
*Seven Letters on the Common School System	1	
*Correspondence on Separate Schools	2	
*Annual Report of the Normal, Model and Common Schools, Upper Canada, 1851	1	
*Do. 1853	1	
*Report on Ice Bridge at Quebec	1	
*Heat and Ventilation, &c.	1	
*Philosophie des Chemins de Fer	1	
*Report on the St. Lawrence and Ottawa Junction Railway	1	
*Report on organizing the Militia	1	

*The Upper Canada Journal	1	Hon. P. de Blaquière.
*Report on Cause of Fire in Parliament Buildings, 1854	1	
*Report on North Shore Railway	1	
*Report on Admiralty Tariff of Fees	1	
*Return—Contracts to the Junction Canal	1	
" Schools in the Ottawa District	2	
" connected with Grand Trunk Railroad	1	
" Montreal Harbour	1	
*Papers—Late Welland Canal Company	1	
*Statement of Expenditure of £30,000 in aid of Settling Vacant Lands in Lower Canada	3	
*County Lotbinere Election Committee	1	
*Report—Catalogue of Books in Library of the Legislative Assembly	1	
*Orders of the Court of Chancery	2	
*Dispatches—referring to Seignoreal Tenure in Lower Canada	1	
*Estimate of Expenses of Civil Government, 1853	1	
*Loose Sheets—The Statutes of Canada.		
*Logan's Geological Survey—Report of Progress, 1848–49	1	
*Do. 1850-51	1	
*Do. 1851–52	1	
	58	

The above list of donations, it will be observed, includes no additions to the Museum. This, there can be little doubt, is mainly ascribable to the want of any adequate means for the classification or display of the objects acquired for this purpose; and it is with sincere satisfaction that the Council anticipate the speedy possession by the Institute of a Hall for its Museum, wherein may be accumulated illustrations of every branch of science, and of the historical antiquities and ethnological relics specially pertaining to the aboriginal races of Canada and the New World.

The following papers have been read at the ordinary meetings of the Institute, during the session 1854–5 :—

Communications.

H. Cowing, Esq.—"Description of a new Steam Plough and Portable Steam Engine for general purposes," with illustrative plans. 2nd Dec., 1854.

Prof. Bovell, M.D.—"On some specimens of Infusoria obtained from Rice Lake and the River Humber,—and on an interesting specimen of Plumatella found in Rice Lake." 16th Dec., 1854.

Prof. Bovell, M.D.—"Remarks on the Respiratory Organs of the Lobster,—and on some peculiarities of the Intestinal Canal of the Bear;" illustrated by prepared specimens. 16th Dec., 1854.

Prof. Wilson, LL.D.—"On some Conchological Relics of the Red Indians of Western Canada, illustrated by specimens of shells and other relics taken from Indian Mounds near Lake Huron." 6th Jan., 1855.

Professors Irving and Cherriman—"On the Eclipse of May 26th, 1854." 13th Jan., 1855.

Prof. Chapman—"Some observations on Carbonate of Lime as an igneous product." 13th Jan., 1855.

Prof. Chapman—"On tho object of tho Salt condition of the Sea." 20th Jan., 1855.

Prof. Cherriman, M.A.—"On the Meterological results of 1854." 20th January, 1855.

Prof. Bovell, M.D.—"On the transfusion of Milk, as practised in the Cholera Sheds at Toronto in 1854." 27th Jan., 1855.

Prof. Wilson, LL.D.—"On traces of the uso of Moveable Types, and imprinting with Coloured Pigments, amongst the Romans of the Second and Third Centuries." 27th Jan., 1855.

Major Lachlan—"An account of an extraordinary Sudden Fall in tho Waters of the Niagara River, in March 1848, caused by a temporary obstruction of the outlet of Lake Erie by Ice." 3rd February, 1855.

Prof. Hind, M.A.—"A Practical Illustration of a mode of Manufacturing Gun Cotton." 3rd February, 1855.

Thos. Henning, Esq.—"On the Asteroids," 10th February, 1855.

Professor Bovell, M.D.—"Some Observations on Microscopic Preparations of Chalk, from Barbadoes, containing Fossil Infusoria." 10th February, 1855.

Sandford Fleming, Esq., C.E.—"Explanation and Mode of Use of Sang's Platometer." 17th February, 1855.

Professor Wilson, LL.D.—"On Some Physical Elements of Ethnological Classification, and their Bearing on the Question of the Unity of the Human Race." 17th February, 1855.

Professor Hind, M.A.—"On the North American Drift." 24th February, 1855.

Rev. Professor Hincks—"On the Classification of Birds." 3rd March, 1855.

Professor Croft, D.C.L.—"Results of Analyses of some Spurious Mexican Coinage." 10th March, 1855.

Rev. W. Bleasdell, M.A.—"On the Indian Tribes of Canada." 10th March, 1855.

Major Lachlan—"On the Union of Lakes Erie and St. Clair." 17th March, 1855.

T. C. Clarke, Esq., C.E.—"On Railway Truss Bridges." 17th March, 1855.

Professor Croft, D.C.L.—"Remarks on a Specimen of Bitumen from the Western District." 17th March, 1855.

Professor Chapman—"Description of a Convenient Method of Tabulating the Organic Remains found in various Strata." 17th March, 1855.

Professor Hind, M.A.,—"On the Origin of the Basins of the Great American Lakes." 24th March, 1855.

F. W. Cumberland, Esq., C. E.—"Notes of a Visit to the Works of the Toronto and Guelph Railroad." 31st March, 1855.

Paul Kane, Esq.—"On the Habits and Customs of the Chinook Indians." 31st March, 1855.

Prof. Chapman.—"Additional Notes on the Saltness of the Sea, being the substance of a communication to Lieut. Maury, U. S. Navy, Superintendent of the Washington Observatory, arising out of a Correspondence on Prof. Chapman's paper published in the March No. of the *Canadian Jonrnal*." 14th April, 1855.

Prof. Chapman—"Further Views and Authorities in support of observations on an example of igneous origin of Carbonate of Lime." 14th April, 1855.

Andrew Hood, Esq.—"Description of a new Astronomical and Surveying Instrument." 14th April, 1855.

T. C. Clarke, Esq., C. E.—"On the Action of the Ice upon the Railway Bridge at Rice Lake." 21st April, 1855.

Prof. Hind, M.A.—"On the occurrence of Crystalized Carbonate of Lime in the Native Copper of Lake Superior." 21st April, 1855.

Sandford Fleming, Esq., C. E.—"Notes on the Welland Canal." 21st April, 1855.

While the Council believe that the above list includes some original papers not less creditable to the Institute than any that have been produced in former years, they feel precluded from any special notice of them, owing to the unusually large share that the members of Council have had to take in this department of the ordinary proceedings. The foregoing list, it will be seen, includes 33 papers, of which the very large proportion of 24 have been contributed exclusively by members of Council. This is a state of things which they feel it to be their duty specially to bring under the notice of the members at large. So numerous a body as the Institute now is, ought to include a much greater number of working members; and the Council are led to believe that their apparent supineness arises, in part at least, from the mistaken idea that communications can only be made in the form of elaborate essays. They would strongly urge on their successors, and on the members at large, the encouragement of brief communications, in greater number, as at once more calculated to give general interest to the ordinary meetings, and to elicit such results of personal knowledge and observation as are best calculated to add to the true value of the published proceedings. Short notices of natural phenomena, features of local geology, objects of natural history, and the like subjects, derived from personal observation, must be readily producible by many members who have

hitherto borne no active part in the Society's proceedings, but whose contributions would most effectually promote the objects which it is designed to accomplish. Among the papers communicated during the past year, the Council have pleasure in referring to three on engineering works of the province, which were appreciated by the members as acceptable contributions to a department to which previous reports have referred, only to express regret at its neglect.

The anticipated resumption for public use, of the apartments occupied by the Institute in the Government House, consequent on the removal of the seat of government to Toronto—to which attention was specially directed in the last Annual Report,—led the Council to devise plans for preventing the best interests of the Institute being affected thereby. The results of these are already known to the members. Temporary rooms, in a convenient locality, have been secured on advantageous terms, and are now occupied, and in use for the regular weekly meetings. The munificent gift by George William Allan, Esq., one of the Vice-Presidents, of a valuable site in Pembroke-street, whereon to erect a permanent Hall for the Institute, was acknowledged in the report of last year; and a general meeting, called for the purpose, authorized the Council to accept the gift, and to take all requisite steps for the erection of a suitable building.

In furtherance of this, two successive grants of £500 each have been made by the Legislature, and an appeal by the Council to the members generally has already been so far responded to, that the Council have to acknowledge a subscription list, which though as yet only including the names of sixty-eight members, out of more than four hundred, amounts to the sum of £716 10s. F. W. Cumberland, Esq., having further liberally offered his valuable services as architect, immediate steps were taken for commencing the permanent building, and on the 13th of November, His Excellency the Governor General was graciously pleased to lay the foundation stone, in the presence of the Council and a large body of the members.

On the evening of the same day, the members of the Institute assembled, by invitation, to a Conversazione at Moss Park, the residence of G. W. Allan, Esq., Vice-President, when His Excellency the Governor General again honoured them with his presence. An interesting collection of objects of natural history and works of art was provided for inspection. Professors Bovell, Croft, Cherriman and Hincks, and Mr. Glen, exhibited a variety of preparations by means of microscopes they had contributed for the use of the members; and papers were read: by Professor Wilson "On Some Associations of the Canadian and English Maple," and by Paul Kane, Esq., "Notes of a Trip to Lord Selkirk's Settlement on Red River, Hudson Bay Company's Territory." The Conversazione proved a highly agreeable reunion, attracting an unusually numerous attendance of members, and placing the Institute under additional obligations to the Vice-President for bringing them together, in circumstances calculated to give a fresh stimulus to the proceedings of the ensuing session, and to have a permanently beneficial effect on the Society.

The Council have much pleasure in congratulating the members on so auspicious a commencement of operations for providing permanent accommodation for the Library and Museum, and a suitable Hall for their meetings, in a building exclusively devoted to the use of the Institute. They recommend to their successors to carry out the object with as little delay as possible; while at the same time it is their duty to remind the members that further liberality on their part will be requisite to enable the Council to execute the plans furnished by the architect, even in a modified form.

The rapid increase in the number of the members of the Institute has forced on the notice of the Council the impossibility of meeting future applications for the early numbers of the Journal, or of obtaining complete sets to present to corresponding Societies; and as the only alternative open to them was the reprinting the earlier numbers at a considerable cost, or commencing a new series: after mature consideration they have determined on the latter course as in all respects most conducive to the best interests of the Society. The necessity of such a change has led to a reconsideration of the whole plan of the Journal, with a view to the more effectual accomplishment of the objects for which it was instituted, and the Council have accordingly, after much deliberation, prepared a scheme for conducting the new series of the Journal, to be submitted to the consideration of the members, at the Annual General Meeting. In laying this plan before the Institute, the Council feel bound to refer to the continued success of the Journal, under its present management, and to record their sense of the zeal with which Professor Hind has fulfilled his duties as editor of the series which it is now proposed to bring to a close.

The Canadian Journal—New Series.

1. The *Journal* to be published in octavo form, each alternate month, beginning with January, 1856.
2. All "Original Communications" to be inserted first, under this or some similar general heading, and whether long or short, to have invariably the name or initials of the author.
3. Original Reviews to form the Second Division in each number, and Reports of the Meetings of the Institute and other Societies, the Third Division.
4. All matter derived from published sources, to be printed in small type, and to form a distinct division, or appendix, under the title of "Scientific and Literary Excerpts," or some other similar heading.
5. The conduct of the *Journal* to be entrusted to an Editing Committee, to be annually nominated by the Council from the general body of the Members of the Institution, at their first meeting in November.
6. The Council to elect one of their Editing Committee as Convener, who shall perform the duties of General Editor in the conduct of the *Journal*, receiving and transmitting communications and works for review, to the members of the Committee to whom their subjects pertain; and exercising the general oversight requisite for the successful issue of a periodical publication.
7. The Convener to summon the Committee, once at least in the interval between the publication of each number, to deliberate on the contents of the succeeding number.
8. To be incumbent on each Member of the Editing Committee to endeavour to obtain original communications of interest and value in his own department, in addition to his own personal contributions.
9. The duties of the Editing Committee, to be classified and divided among its members, according to the following subdivisions, subject to alteration or addition by the Council:—I. Geology and Mineralogy. II. Physiology and Natural History III. Ethnology and Archæology. IV. Agricultural Science. V. Chemistry. VI. Mathematics and Natural Philosophy. VII. Engineering and Architecture.

The Council have much pleasure in congratulating the members on the highly satisfactory results shown by their financial statement for the present year, notwithstanding the extraordinary expenditure unavoidably incurred, in consequence of the removal from the rooms hitherto occupied, free of cost, in Government House, and the increase in the items of salary and rent, which the Treasurer's accounts show, in comparison with last year. The following statement, it will be seen, includes a sum of £150, received from the Athenæum, being the balance of two annual grants of £100 each, made by the Legislature to the Athenæum, for the purpose of carrying out the special objects which the Canadian Institute has now undertaken to accomplish. Of this sum, the Council recommend that £75 be added to the Building Fund, as an object in which the Library department is specially interested, and that the remainder be expended on books. The subjoined statement exhibits a balance in favour of the Institute of £1438 18s. 4d.

This, however, it must be borne in remembrance, not only includes the special Government Grant of £1000 to the Building Fund, but also the sum of £187. 2s. of arrears and money due on account of Journal, no portion of which has yet been received by the Treasurer. The balance from 1854 also embraced, in like manner, the arrears of the year. In addition to this, there remain several outstanding accounts, including one of Messrs. Jacques and Hay, for fitting up the rooms now occupied by the Institute, in York Buildings, and for providing the requisite shelving for the large additions to the Library, consequent on the acquisition of the valuable collection of Books hitherto pertaining to the Toronto Athenæum, as well as the considerable additions acquired by donation and purchase. After all accounts are discharged, there will still remain a balance in hand, some portion of which the new Council will probably deem it advisable to transfer to the Building Fund.

ESTIMATE OF THE PRESENT POSITION OF THE CANADIAN INSTITUTE.

		£	s.	d.
Cash Balance from last year		85	16	3
" for Sale of Journal	£134 1 1½	438	12	6
" " Subscriptions received	304 11 5			
" Waste Paper sold		2	6	10
" Due by Subscribers on account of Journal	£ 49 8 9	187	2	0
" Arrears due by Members	137 13 3			
" Government Grant for 1854		250	0	0
" " " for 1855		250	0	0
" " " in aid of Building		1000	0	0
" due on union of the Athenæum with the Institute		150	0	0
		£2363	17	7

		£	s.	d.
Paid Cash on account of the publication of the Journal for 1854	£83 1 2			
" Ellis & Co., for engraving Logan's Geological Map and the Victoria Bridge, &c.	84 1 4			
" Proof Reader	32 10 0			
" Publication of Toronto Harbour Reports.	63 19 0			
" Publication of the Journal for 1855	286 13 7			
		550	5	1
" Sundries on account of the Institute		135	11	6
" for Library Books and Periodicals		67	1	4
Balance due Maclear & Co. on account of Journal		52	0	5
" " Armour & Co. on account of Library		15	14	3
" " Assistant Secretary's Salary, to date		12	10	0
" " H. Piper, on account of the Institute		2	11	3
" " H. Rordens		1	6	3
" " Jacques & Hay for new Shelves in Library		30	5	0
" " Ogilvie & Co.'s account against Institute		2	14	2
" " Editor of Journal		50	0	0
" " Reader		5	0	0
		924	19	3
Estimated Excess in favor of the Institute		£1438	18	4

COPY OF AUDITORS REPORT, 1855.

The Auditors beg to report to the Council of the Canadian Institute, that they have examined the Accounts for the year ending the 30th of November, 1855, as shown by the Cash Book, the Treasurer's account and corresponding Vouchers, and which shew a balance of One Thousand Two Hundred and Seventy-three Pounds Seventeen Shillings and Eight Pence; £1000 of which is invested and £273 17s. 8d. in the Bank and Treasurer's hands, and which balance appears to them as correct.

D. CRAWFORD,
SAMUEL SPREULL. } *Auditors.*

Toronto, 8th Dec., 1855. CANADIAN INSTITUTE.

In closing this Report, the Council beg leave to congratulate the members of the Institute on the very promising aspect which its affairs present, and in resigning their duties to their successors, to express their earnest hope that the day is not very far distant, when this Institution will be recognized as one contributing to the advancement of the Province in an intellectual progress commensurate with its material prosperity.

The President having nominated Messrs. Harman and Mortimer scrutineers, the election of officers for the ensuing year was proceeded with by ballot.

Upon the reception of the Report of the Scrutineers, the President announced the election of the following gentlemen to the undermentioned offices respectively :—

President:
G. W. ALLAN, Esq.

First Vice-President—JAMES BOVELL, M.D.

Second Vice-President—E. A. MEREDITH, Esq.

Recording Secretary—F. W. CUMBERLAND, Esq.

Corresponding Secretary—THOS. HENNING, Esq.

Treasurer—DALRYMPLE CRAWFORD, Esq.

Librarian—SANDFORD FLEMING, Esq.

Curator—PROFESSOR CHAPMAN.

Council:

Professor WILSON, LL.D.	Professor HIND, M.A.
Professor CROFT, D.C.L.	SAMUEL THOMPSON, Esq.
Professor CHERRIMAN, M.A.	OLIVER MOWAT, Esq.

The following gentlemen were elected members :—

John W. Dawson. F.G.S.	Montreal.
Rev. W. A. Johnson	Toronto.
Rev. John Taylor	"
Arthur Carter (jun. mem.)	"
Donogh O'Brien do.	"

The names of the following candidates for membership were read :—

Robert Selby Cameron	Toronto.
Thos. S. Hill	Yorkville.
Dr. Haswell	Toronto.
C. E. Anderson	"
W. McDonald Dawson	"
G. W. Wickstead	"
Edmund Morris	"
Joseph T. Kerby	"
For Life Membership :—	
John Page	Matilda, C.W.

The following donations were announced :—

For the Library.

From the Hon. J. M. BRODHEAD, of Washington, per A. H. ARMOUR :

1. Message and Documents from the President of the United States to the Senate—1854 and 1855. Parts I. & II.
2. Address on the presentation of the Sword of General Jackson.
3. Andrews' Report on Colonial and Lake Trade—1852.
4. Maps to accompany the above.
5. Commerce and Navigation—1853.
   " " 1854.
   " " 1855.

From A. H. ARMOUR, Toronto:

Arcadian Geology, by John William Dawson, F.G S.

For the Museum.

From the Rev. G. BELL, Simcoe, N. .

A specimen of Fossiliferous Limestone.

From W. COUPER, Toronto :

Specimens of Worms found in Grasshoppers at Montreal.

From W W. BALDWIN, Toronto :

A box of Minerals.

The thanks of the Institute was ordered to be transmitted to the Hon. J. M. Brodhead; Mr. Armour; Rev. G. Bell; W. Couper, and W. W. Baldwin, for their respective donations.

A paper was read by Prof. Bovell, "On some points in the Natural History of the Leech."

Also a paper by G. J. Hodgins, Deputy Superintendent of Schools, "On a specimen of the Proteus of the Lakes."

It was resolved that the specimen produced, together with the paper read by Mr. Hodgins, be referred to Prof. Bovell, Croft, and Chapman, to consult with Mr. Hodgins thereon, and to report to the Institute.

The following resolutions were then submitted, and passed by acclamation:

1. That the cordial thanks of the Institute be presented to Sir John Beverly Robinson, Bart., for his kind and efficient services as President of the Institute for the past two years.

2. That the thanks of the Institute be presented to the Vice-Presidents and other Officers for their zealous services during the past year.

COPY OF INDENTURE RELATING TO THE UNION OF THE CANADIAN INSTITUTE AND TORONTO ATHENÆUM.

THIS INDENTURE, made the twenty-eighth day of November, one thousand eight hundred and fifty-five, between the Toronto Athenæum of the one part, and The Canadian Institute of the other part; Whereas, by an Act passed in the eleventh year of the Reign of her Majesty, Queen Victoria, intituled, "An Act to Incorporate the Toronto Athenæum," power was given to certain persons therein named to form themselves into an Association for the formation of a Public Library and Museum, as therein mentioned; and Whereas an Association was formed accordingly; and Whereas a Royal Charter was granted on the fourth day of November, one thousand eight hundred and fifty-one, to an Association called the Canadian Institute, for purposes of a similar character; and Whereas the said two Bodies, being desirous of a union thereof, did, prior to the passing of the Act hereinafter mentioned, intituled, "An Act to Amend an Act to Incorporate the Toronto Athenæum," agree upon the terms and conditions for such union, subject to the obtaining of an Act authorizing the same, and which terms and conditions were to the effect following, that is to say—

1. That the Library formed by the Books of the two Institutions, with such additions as may be made from the common funds, should constitute a Library to which the Public should have access, for reference, free of charge, under such regulations as may be adopted by the said Canadian Institute, in view of the proper care and management of the same.

2. That the members of the said Athenæum should become members of the said Canadian Institute.

3. That the Governors of the Athenæum should be elected Life Members of the said Canadian Institute.

4. That all members of the said Athenæum, who should have paid their subscriptions for the current year, prior to or at the period of the union of the two bodies, should be considered as members of the said Institute, and entitled to receive the Journal published by the Institute for the present year without further charge, it being optional with them to retire from the Institute at the close of the present year, should they desire to do so.

5. That each of the Life Governors of the said Athenæum, upon being elected Life Members of the said Institute, should also be entitled to the said Journal, free of charge, should they desire to receive the same.

6. That there should be handed over to the said Canadian Institute by the said Athenæum, upon the union of the said two bodies, the sum of one hundred pounds of the money of the Athenæum.

That upon the arrangements for the amalgamation being assented to by both bodies, the Books and Minerals belonging to the said Athenæum should be transferred to the Canadian Institute, and arranged in their rooms, and that during the ensuing Summer months the Library should be opened for the Public, under proper regulations, at least one day in the week.

And it was thereupon agreed by and between the said two bodies, that the necessary steps should be taken to obtain the sanction of the Parliament of this Province to the union aforesaid.

And Whereas, by an Act passed in the eighteenth year of the reign of her Majesty Queen Victoria, intituled, "An Act to amend an Act to Incorporate the Toronto Athenæum," it was enacted that the members of the Toronto Athenæum should have power to transfer and convey to the Canadian Institute such and so much of the Books, Minerals, and other property of the said Toronto Athenæum, whether held absolutely or in trust, as they might decide upon so conveying, and upon such conditions as they might think advisable, which conditions, if accepted by the said Canadian Institute, should be binding.

And Whereas, since the passing of this Statute, the said members of the Toronto Athenæum have decided upon conveying to the said Canadian Institute, upon the conditions hereintofore referred to, all the Books and Minerals now belonging to the said Toronto Athenæum, and Whereas, such conditions have been accepted by the said Canadian Institute.

And Whereas, the members of the said Athenæum have been duly received and become and now are members of the said Canadian Institute, and the Governors of the said Athenæum have been duly elected Life Members of the said Canadian Institute, and the said members of the said Athenæum have, or will, at or before the execution of these presents, hand over to the said Canadian Institute the said sum of one hundred and fifty pounds.

Now this Indenture Witnesseth, that for the purpose of completing the said Union, and in consideration of the premises and also in consideration of the sum of Ten Shillings of lawful money of Canada now paid by the said The Canadian Institute to the said the Toronto Athenæum, receipt whereof is hereby acknowledged, the said the Toronto Athenæum doth render and by virtue of the power in that behalf contained in the said act passed in the eighteenth year of the Reign of Her present Majesty intituted "An Act to amend an act to incorporate the Toronto Athenæum and under and by virtue of all other powers in this behalf, grant, assign, transfer, convey and set over unto the said The Canadian Institute all the Books and Minerals whatsoever now belonging to the said the Toronto Athenæum, to have, receive and take all such Books and Minerals hereby assigned, or intended so to be, unto the said the Canadian Institute absolutely forever.

In Witness whereof the President of the said Athenæum hath hereto set his hand, and the said Athenæum hath hereunto, by the said President, affixed the common Seal of the said Athenæum. And the President of the said Canadian Institute hath hereto set his hand and the said Institute hath hereunto, by the said President, affixed the Corporate Seal of the said Institute the day and year first above written.

Signed, sealed and delivered in the presence of
E. CHADS HANCOCK,
Sec. Toronto Athenæum.

SAMUEL THOMPSON,
Pres't Athenæum.
J. B. ROBINSON.
Pres't Canadian Institute.

Alphabetical List of Members of the Canadian Institute.

Names.	*Residence.*		
Adamson, Rev. W. A., (D.C.L.) ...	Toronto,	C.W.	
Allan, G. W.	"	"	Moss Park.
Anderson, C. E.	"	"	
Andrew, Professor W.	Quebec,	C.E.	
Armour, A. H.	Toronto,	C.W.,	Wellington St.
Armstrong, W.	"	"	Queen "
Arnold. John	"	"	Peter "
Badgley, Prof. F.	"	"	Bay "
Bain, James	"	"	
Baker, Hugh C.	Hamilton,	"	
Baldwin, Hon. Robt. (C.B.)	Spadina, near Toronto, C.W.		
Baldwin, W. W.	Oakridges, C.W.		
Baldwin, Robt. Junr.	Spadina, near Toronto, C.W.		
Baldwin, W. A.	Mashquoteth, near Toronto, C.W.		
Baldwin, Maurice S.	Toronto,	C.W.,	Duke Street.
Barclay, Rev. J.	"	"	" "
Barron, F. W.	"	"	U. C. College.
Bartlett, Rev. T. H. M.	Kingston,	"	
Battersby, W.	Toronto,	"	
Battersby, Leslie	"	"	
Beatty, G.	"	"	
Beaven, J. F.	London,	"	
Beaven, E. W.	Orillia,	"	Trinity College.
Beard, Charles	Woodstock,	"	
Becher, H. C. R.	London,	"	
Becher, Capt., R. N.	"	England.	
Bell, Rev. Andrew	L'Orignal, C.W.		
Bell. Robert, M.P.P.	Carleton Place, C.W.		
Bell, Rev. George	Simcoe,	C.W.	
Bennett, H.	Toronto,	"	
Beresford, W. H.	"	"	
Bernard, H.	Barrie,	"	
Berry, Edward	Quebec,	C.E.	
Bethune, Prof. N.	Toronto,	C.W.,	Richmond St.
Billings, E.	Ottawa,	C.E.	
Birchall, T. W.	Toronto,	C.W.	
Bird, James	Peterboro'	"	
Blackie, John	Danville,	C. E.	
Black, James	Ayr,	C. W.	
Blake. E. D.	Toronto,	"	Bay Street.
Bleasdell, Rev. W.	Trenton,	"	
Blight, W.	Toronto,	"	
Bogert, J. J.	"	"	Trinity College.
Boomer, A, K.	"	"	Bay Street.
Bostwick, A.	"	"	
Boulton, W. H.	"	"	John Street.
Boulton, Hon. H. J.	"	"	Wellington St.
Bovell, Prof. James	"	"	St. George's Sq.
Bown, H. T.	Brantford,	"	
Boyd, Francis	Toronto,	"	Bay Street.
Bradburne, E.	"	"	
Bradbury, J. R.	"	"	
Brent, J. W.	"	"	
Bristow Arthur	Weston,	"	
Brondgeest, J. T.	Toronto,	"	Yorkville.
Brough, S.	"	"	Simcoe Street,
Brooke, D. Senr.	"	"	
Brooke, G.	"	"	
Brown, Geo., (M.P.P.)	"	"	Church Street.
Brown, James	"	"	Peter Street.
Brown, Philip	"	"	"
Browne, George	Montreal,	C. E.	
Brown, John	Thorold,	C. W.	
Browne, J. O.	Toronto,	"	Yorkville.
Brunel, Alfred	"	"	Brock Street.
Brunskill, Thos.	"	"	Shuter Street.
Buchan, David	"	"	Yorkville.
Buckland, Prof. G.	"	"	Park Lane.
Bucll, A. N.	"	"	
Burke, J. W.	Renfew,	C. W.	
Burnet, Rev. R.	Hamilton.	C. W.	
Burwell, Lewis	Brantford,	"	

Names.	*Residence.*		
Cameron, Angus	Toronto,	"	
Cameron, Dr. A.	Owen Sound,	C.W.	
Cameron, Peter	Toronto,	C.W.	
Cameron, R. Selby	"	"	
Cameron, J. M. A.	"	"	Canada Co. Office.
Cameron, Hon. Malcolm	Port Sarnia,	"	
Cameron, John	Toronto,	"	Duke Street.
Cameron, Hon. J. H., M.P.P.	"	"	The Meadows.
Cameron, Hector	"	"	Wellington St.
Cameron, Col. K.	Beaverton,	"	
Campbell, C. J.	Toronto,	"	Com. Bank.
Campbell, Major T. E., C.B.	St. Hilaire, C.E.		
Campbell, E. C.	Niagara, C.W.		
Campbell, W. D.	Quebec, C.E.		
Carter, Dr.	Nelson,	C.W.	
Carter, Arthur	Toronto,	"	Trinity College.
Carruthers, F. F.	"	"	Ann Street.
Carlyle, Arch.	Orillia,	"	
Cassels, W. G.	Toronto,	"	
Cayley, F. M.	"	"	
Cayley, W. F.	"	"	
Chapman, Prof. E.	"	"	Yorkville.
Cherriman, Prof. J. B.	"	"	Yorkville.
Chewett, W. C., M.D.	"	"	York Street.
Clarke, E., M.D.	"	"	Gen. Hospital.
Clarke, T. C.	Port Hope,	"	
Clarkson, Thos.	Toronto,	"	
Connor, Skeffington, L.L.D.	"	"	Bay Street.
Copp, W. W.	"	"	Alexander St.
Cortlandt, H. N.	Simcoe, Norfolk, C.W.		
Cottle, T. J.	Woodstock, C.W.		
Cotton, James	Toronto,	"	Church Street.
Couper, W.	"	"	Queen Street.
Covernton, Dr. C. W.	Simcoe,	"	
Cowan, Isaac	Toronto,	"	
Cowdry, Dr. T.	Cobourg,	"	
Craigie, Doctor W.	Hamilton,	"	
Crawford, D.	Toronto,	"	Jarvis Street.
Crawford, James	Brockville	"	
Croft, Prof. H.	Toronto,	"	Yorkville.
Crombie, E. M.	"	"	George Street.
Crooks, Adam	"	"	King "
Cull, E. L.	"	"	
Cumberland, F. W.	"	"	Duke "
Dartnell, E. T. }	Toronto,	C.W.,	Peter Street.
Dartnell, G. H. }			
Davies, W. H. R.	Montreal,	C.E.	
Davies, H. W.	Toronto,	C.W.,	Trinity College.
Dawson, J. W., (F.G.S.)	Montreal,	C.E.	
Dawson, W. McDonald	Toronto,	C.W.,	C L. Dept.
De Blaquiere, Hon. P. B.	"	"	Yorkville.
De Rottenburg, Col. Baron	"	"	
Dennis, J. S.	"	"	
Dennison, R. L.	"	"	Dundas Street.
Devine, Thomas	Toronto, C.W.		
Dewe, J.	Toronto,	C.W.,	
Dick, Captain T.	Toronto,	"	Queen St. West.
Dickson, Andrew	Pakenham,	"	
Dixon, W.	Toronto,	"	
Dixon, Joseph	"	"	
Dixon, W.	"	"	
Dodgson, R.	"	"	
Donaldson, Captain W.	St. Catherines, C.W.		
Draper, Hon. Mr. Justice (C.B) ...	Toronto,	C.W.,	Yorkville.
Drummond, A.	"	"	Gerrard Street.
Duggan, Geo. Junr.	"	"	Adelaide "
Duggan, John	"	"	Bay "
Ellis, J. E.	"	"	King "
Ellis, Joseph	Port Hope,	"	
Ellis, John	Toronto,	"	King Street.
Ermatinger, James	Stoney Creek, C.W.		
Esten, J. H.	Toronto,	C.W.,	St. George's Sq.
Evans, W. C.	Montreal, C.E.		
Ewart, John, Junr.	Toronto,	C.W.,	Church Street.
Ewart, John	"	"	

Names.	*Residence.*		
Farley, James	St. Thomas,	"	
Farmer, A. A.	Woodstock,	"	
Ferrie, Robert (M.P.P.)	Doon,	"	
Fitzgerald, W. W.	Toronto,	"	Adelaide Street.
Fitzgerald, W J.	Toronto,	C. W.	Wellington St.
Fitzgibbon, C.	"	"	St. George's Sq.
Fleming, S.	"	"	Victoria Street.
Flesher, W. K.	Artemesia,	"	
Forlong, Col. J.	Toronto,	"	
Forneri, R.	"	"	
Forrest, J. W.	Hamilton,	"	
Fowler, Henry	Toronto,	"	Wellington S.
Freeland, Patrick	"	"	Bay Street.
French, D. O.	"	"	Bay Street.
Fripp, H. G. R.	"	"	Yonge Street.
Galt, Thomas	"	"	
Gamble, W.	"	"	
Geddes, Rev. J. G.	Hamilton,	"	
Geikie, Rev. A.	Toronto,	"	Yonge Street.
Gibb, Doctor G. D.	London, England.		
Gibson, David	York Mills,	"	
Gilbert, James	Toronto,	C. W.	
Glen, W.	"	"	
Good, James	"	"	Yonge Street.
Goodenough, R. A.	"	"	
Grahame, W. R.	"	"	Richmond St.
Grant, Alexander	"	"	
Grant, John	Whitby,	"	
Grasett, Rev. H. J.	Toronto,	"	Adelaide Street.
Gray, Rev, J.	Orillia.	"	
Gregory, T. C.	Windsor,	"	
Grier, Robert J.	Toronto,	"	
Gwynne, H. N.	"	"	
Gzowski, C. S.	"	"	Elm Street.
Hagarty, Dr. J. H.	"	"	William Street.
Hale, W. D.	Port Stanley, C.W.		
Hallan, S. W.	Penetanguishene, C.W.		
Hall, Dr. A.	Montreal,	C.E.	
Hall, G. B.	Nanticoke	"	
Hall, James	Peterboro,	C.W.	
Hallowell, Prof. W., M.D.	Toronto,	"	Duke Street.
Hamilton, J. M.	"	"	
Hancock, E. C.	"	"	Jarvis Street.
Hanvey, Daniel	St. Thomas,	"	
Harman, S. B.	Toronto,	"	St. George's Sqr.
Harrington, John	"	"	King Street.
Harrison, Hon. S. B.	"	"	Dundas Street.
Harrington, T. D.	"	"	
Harris, John F. J.	London,	"	
Harris, W. R.	Toronto,	"	
Harris, T. D.	"	"	Duke Street.
Haswell, Dr.	"	"	
Hawke, A. B.	"	"	
Hawkins, W.	"	"	King Street West.
Haycock, T. H.	Chippewa,	"	
Helliwell, John	Toronto,	"	
Hemings, G.	"	"	
Herrick, T. W.	London,	"	
Herrick, Doctor George	Toronto,	"	Church Street.
Henning, Thomas	"	"	Queen Street.
Heward, W. B.	"	"	Yorkville.
Heward, Stephen	"	"	
Heyden, L.	"	"	
Heyden, L., Junior	"	"	
Hill, Thomas J.	"	"	Yorkville.
Hind, Prof. H. Y.	"	"	Spadina Avenue.
Hind, W.	"	"	
Hincks, Hon. Francis	Governor of Barbadoes.		
Hincks, Rev. Prof. W.	Toronto,	C.W.	Yorkville.
Hingston, Dr. W.	Montreal	C.E.	
Hirschfelder, J.	Yorkville	C.W.	
Hodder, Prof. E. M.	Toronto,	"	Queen Street.
Hodgins, W.	Hamilton,	"	

Names.	*Residence.*		
Hodgins, J. G.	Toronto,	"	Bond Street.
Hodgins, Thos.	Toronto,	"	McGill Street.
Holcomb, S. F.	Hamilton,	"	
Holwell, W. A.	Quebec,	C.E.	
Holland, John	Toronto,	C.W.	
Holland, G. B.	Toronto,	C.W.,	King Street.
Hood, Andrew	Dunnville	"	
Houghton, E.	Port Stanley, C.W.		
Horwood, G. C.	Toronto,	C.W.	
Howard, J. G.	"	"	King Street.
Howard, J. S.	"	"	Gerrard Street.
Howland, W. P.	"	"	
Hunt, T. S.	Montreal, C.E.		
Hutcheson, John	Toronto,	C.W.,	Church Street.
Jacques, John	"	"	Front Street.
Jamieson, W. M.	"	"	King Street.
Jarvis, W. B. (Sheriff)	"	"	
Jarvis, C. H.	Hamilton,	"	
Jarvis, C. B.	Toronto,	"	
Johnston, R. J.	Thorold,	"	
Johnston, Rev. W. A.	Toronto,	"	
Jones, W.	Port Stanley, C.W.		
Jones, C.	Toronto,	C.W.	
Jones, E. R.	Sarnia,	"	
Irving, Rev. Prof. G. C.	Toronto,	"	Trinity College.
Joseph, J. G.	"	"	King Street.
Jukes, Dr. A.	St. Catherines, C.W.		
Kane, Paul	Toronto,	C.W.	
Keefer, Samuel	Montreal,	C. E.	
Keefer Thomas	"	"	
Kerby, Jos. T.	Toronto,	C.W.,	
Kingsford, W.	"	"	
Kingston, Prof. C.T.	"	"	University.
Kneeshaw Richard	"	"	
Lachlan, Major R.	Montreal,	C.E.	
Laidlaw, John	Toronto,	C.W.	
Lambe, W. H.	Montreal,	C.E.	
Langton, John,	Toronto,	C.W.	
Latour, L. A. Huguet	Montreal,	C.E.	
Lawson, Walter	Guelph,	C.W.	
Lawford, T. W.	London,	"	
Lawrason, L.	"	"	
Leach, Rev. Dr. W. T.	Montreal,	C.E.	
Lefroy, Lieut.Col. J.H., R.Artillery	Woolwich, England.		
Leith, Alexander	Toronto,	C.W.	
Lewis, Rice	"	"	King Street.
Logan, W. E. (F.R.S.)	Montreal,	C.E.	
Logie, A.	Hamilton,	C.W.	
Macaulay, J. J.	"	"	Carlton Street.
Maddison, G. L.	Toronto	C. W.	
Macdonell, D.	"	"	Yonge Street.
MacGregor, P.	"	"	
Mack, Doctor T.	St. Catherines,	C. W.	
Mackenzie, H. M.	Guelph,	"	
Mackinnon, John.	Ottawa,	"	
Macklem, Doctor Thomas C.	Chippewa.		
Maclear, Thomas.	Toronto,	C. W.,	King Street.
Macpherson, D. L.	"	"	
Major, John.	"	"	
Masson, John.	Hamilton,	"	
Matheson, W. M.	Toronto,	"	
May, Henry.	Quebec,	C. E.	
Mayer, S. D.	Toronto,	C. W.	Adelaide Street.
Mercer, W.	Simcoe,	"	
Meredith, E. A.	Toronto,	"	
Merrick, J. D.	"	"	
Miller, Hugh.	"	"	
Miller, T. J.	"	"	
Mitchell, John.	Montreal,	C. E.	
Mitchell, James.	Toronto,	C. W.	
Moberly, Walter.	"	"	Church Street.
Moffatt, Lewis.	"	"	Yonge Street.

Names.	*Residence.*	
Monro, George	" "	
Morphy, G.	" "	
Moodie, J. W. D. (Sheriff)	Belleville "	
Moore, John.	Toronto, "	King Street.
Morris, W. J.	Perth, "	
Morris, Alexander.	Montreal, C. E.	
Morris, Edmund.	Toronto, C. W.	
Morrison, J. C., (M. P. P.)	" "	
Mortimer, H.	" "	
Mowat, O.	" "	Church Street.
Mulholland, John	" "	"
Murney, Edward H.	Belleville "	
Murray, Alexander.	Woodstock, C. W.	
Murray, H. W. M.	Toronto, "	John Street.
Murray, A.	" "	
M'Callum, James, Jr.	Uxbridge, C. W.	
M'Caul, Rev. John, (L.L.D.)	Toronto, "	Carlton Street.
M'Clary, William	London, "	
M'Cord, A. T.	Toronto, "	
M'Donald, Donald	Toronto, "	Queen Street.
M'Donald, Alex.	" "	King "
M'Donell, Alex.	Hamilton, "	
M'Farlane, Walter	Toronto, "	
M'Gill, Hon. Peter	Montreal, C.E.	
M'Gregor, C. J.	Stratford, C.W.	
M'Intyre, N. C.	Toronto, "	
M'Kenzie, Walter	Yorkville, "	
M'Kerras, Rev. J. H.	Darlington, "	
M'Lean, Allan	Toronto, "	
M'Nab, John	" "	Church Street.
M'Namara, M.	" "	
M'Master, Wm.	" "	
M'Phillips, G.	Richmond Hill, C.W.	
M'Murray, Rev. W.; (D. D.)	Dundas, C.W.	
M'Queen, Thos.	Goderich, "	
Nanton, Augustus	Toronto, "	
Netting, George	" "	King Street.
Newton, Doctor J. S.	Sault St. Mary, U.S.	
Nicol, Doctor W. B.	Toronto, C.W.,	Adelaide Street.
Noble, Capt. A. R. Artillery	Quebec, C.E.	
Northcote, Henry	Toronto, C.W.,	King Street.
O'Brien, E. G.	" "	Church Street.
O'Brien, W.	Barrie, "	
O'Brien, Donough	Toronto, "	
O'Brien, L. R.	" "	Church Street.
Orchard, T. C.	" "	Front Street.
Page, John	Matilda, "	
Palmer, E. J.	Toronto, "	King Street.
Pardey, W. H.	" "	"
Parkes, Vincent	Toronto, "	Adelaide Street.
Passmore, F. F.	" "	King Street.
Paterson, D.	" "	
Paterson, Peter	" "	
Patrick, Alfred	" "	Gerard Street.
Patton, John	" "	King "
Pell, J. E.	" "	King "
Perram, J.	Tecumseth, C.W.	
Perrin, W. L.	Toronto, "	
Perley, M. H.	St John's, New Brunswick.	
Perkins, Frederick	Toronto, C.W.,	Peter Street.
Perkins, George	" "	Wellington St.
Peterson, H. W.	" "	
Philbrick, Prof. C. J.	" "	Yorkville.
Phillips, T. D.	Paris, "	
Piper, Hiram	" "	Yonge Street.
Platt, Samuel	" "	
Platt, George	" "	
Polley, W.	" "	
Pringle, J. D.	Hamilton, "	
Prossor, T. C.	Bolton, Albion, C.W.	
Proudfoot, W.	Toronto, C.W.	
Pyper, G. A.	" "	
Pyper, W.	" "	Wellington St.

Mames.	*Residence.*	
Ransom, W. W.	" "	
Read, D. B.	" "	Queen Street.
Reekie, James	Quebec, C.E.	
Reid, J. B.	Toronto, C.W.	
Reid, Rev. W.	" "	Knox's College
Rennie, Alex.	Montreal, C.E.	
Richardson, J. H., M.D.	Toronto, C.W.,	Bay Street.
Richards, Hon. Mr. Justice	" "	Yonge Street.
Richey, John, Jr.	" "	King Street.
Ridont, Thomas	" "	Bay Street.
Ridout, J D.	" "	
Ridout, G. P.	" "	King Street.
Ridout, J. G.	" "	Bank U.C.
Ridout, Charles	" "	Maria Street.
Ridout, T. G.	" "	Bank U.C.
Ritchie, Rev. W.	Georgina, "	
Robarts, T P.	" "	William Street.
Robertson, Charles	" "	
Robertson, T. J.	" "	Wellington St.
Robins, S. P.	Brantford, "	
Robinson, Hon. W. B. (M.P.P.)	Toronto, "	Duke Street.
Robinson, Hon. Sir J. B., Bart., Chief Justice,	" "	Beverley House.
Robinson, W.	London "	
Robinson, Christopher	Toronto, C. W.	Beverley House.
Robinson, J. Lukin.	" "	Peter Street.
Robinson, Joseph.	Yorkville, "	
Ross, James (M.P.P.)	Belleville, "	
Ross, W. C.	Toronto, "	
Rossin. Samuel	" "	
Rowsell, Henry	" "	York Street.
Rubidge, F. P.	" "	
Russell, Dr. F.	" "	Duke Street.
Russell, A.	" "	
Rutherford, E. H.	" "	
Ruttan, Henry.	Coburg, "	
Ryerson, Rev. E.; D. D.	Toronto, "	Victoria Street.
Rykert, G. Z.	St. Catherines, C. W.	
Rykert. A. E.	Toronto, C. W.	Trinity College.
Sabine, Col. E.; (R. Artillery)	Woolwich, England.	
Salter, A. P.	Chatham, C. W.	
St. George, H. Q.	Oakridges, "	
Sangster, John. H.	Hamilton, "	
Savigny, H. P.	Barrie, "	
Scadding, Rev. H.,	Toronto, "	U. C. College.
Schofield, M. C.	Berlin, Waterloo, C. W.	
Scholefield, C. K.	Oakville, C. W.	
Schreiber, Thomas, Rev.	Toronto, "	
Schreiber, Collingwood.	" "	
Scott, A. F.	" "	
Sears, S. B.	Chatham, "	
Shanly, Walter.	Toronto, "	Wellington St.
Shanly, Francis	" "	Bay Street.
Shier, John	Whitby, "	
Shortis Ed.	Toronto, "	
Shortt, P. L.	" "	
Simons, T. M.	Hamilton, "	
Simpson, Sir G.	Lachine, C.E.	
Simpson, A. W.	Toronto, C.W.	
Sladden, W.	" "	Church Street.
Small, Rev. J. W.	" "	Queen "
Small, Jas. C.	" "	Front "
Small, Dr. John	" "	Duke "
Small, Jos. C.	Collingwood Habour, C.W.	
Smallwood, Doctor Charles.	Isle Jesus, C.E.	
Smith, Larratt W., D.C.L.	Toronto, C.W.	
Smith, William.	Woodstock, Oxford, C.W.	
Smith, J. F.	Toronto, C.W.	
Smith, Rev. Prof. J. M.	Kingston, "	Queen's College.
Sootheran, G. H.	Toronto, "	Yorkville.
Spence, Hon. Robt. M.P.P.	" "	
Spragge, Hon J. G. (Vice Chan'r.)	" "	Portland Street.
Spratt, Robert	" "	Jarvis Street.
Spreull, Samuel	" "	Yonge Street.
Stark, David	Montreal C.E.	

Names.	*Residence.*
Stennett, W.	Toronto, C.W.
Stephens, Romeo H.	Montreal, C.E.
Stephenson, Robert (M.P.)	England.
Stevenson, James	Toronto, " Bank of Montreal.
Stewart, Wm.	" "
Stewart, G. A.	Port Hope, "
Stewart, Chas.	Toronto, "
Storm, W. G.	" "
Street, R. P.	Gore Bank, Hamilton, C.W.
Street, T. C.	Niagara Falls.
Sullivan, A.	Toronto, C.W., Carlton Street.
Taylor, Rev. John	" "
Toronto, Rt. Rev. Lord Bishop of...	" " Front Street
Thibodo, A. J. (M.B.)	Trenton, "
Thomas, George	" "
Thomas, W.	Toronto, " Church Street.
Thomas, C. P.	" " " "
Thomas, G.	Chatham, C. W.
Thomson, E. W.	York Township, C. W.
Thompson, Samuel	Toronto, C. W.
Thompson, T. J.	" "
Thompson, J. E.	" "
Thompson, John	" " John Street.
Todd, H. C.	" "
Torney, Hugh	Ottawa, "
Torrance, T. W.	Montreal, C. E.
Torrance, J. A.	Toronto, C. W.
Turner, C. H.	England.
Turner, Loftus	Toronto, C. W.
Turner, H. (M. D.)	Galt, "
Unwin. Charles	Toronto, "
Ure, G. P.	" " Terauley Street.
Valentine, J. S.	Niagara, "
Vankoughnet, P. M.	Toronto, " Wellington Street.
Vidal, Alex	Sarnia "
Walsh, F. L.	Simcoe, "
Walsh, T. W.	" "
Walsh, Robt.	Lloydtown, C. W.
Walker, E. A.	Barrie, "
Weatherly, Capt.	Toronto, " Provincial In. Co.
Webster, Jas.	Guelph, "
Weir, Rev. Prof. G.	Kingston, " Queen's College.
Weller, W. H.	Cobourg, "
Wells, Robt.	Toronto, " Park Lane.
Whitney, F. A.	" " Toronto Street.
Whitney, J. W. G.	" " "
Whittemore, E. F.	" " Bay Street.
Whitwell, Rev. R.	Philipsburg, C. E.
Wicksteed, G. W.	Toronto, C. W.
Widder, Fred'k.	" " Lyndhurst.
Williamson, Rev. Prof. J.	Kingston, " Queen's College.
Wilkinson, J. A.	Sandwich, "
Wilkes, G. S.	Brantford, "
Wilson, John M., (M.P.P.)	London, "
Wilson, Prof. D. LL. D.	Toronto, " Yorkville
Wilson, Dr. Jas.	Perth
Wilson, George	New York.
Wilson, W. M.	Simcoe, C. W.
Woodruff, S. D.	St. Catharines, C. W.
Workman. Dr. B.	Montreal, C. E.
Workman, Dr. Jos.	Toronto, C. W.
Worthington, Thomas.	Wellington, P, E. District, C. W.
Worthington, John.	Toronto, C. W. Temperance St.
Worts, J. G.	" " Front Street.
Wright, Alfred.	" "
Wright, James.	" " Queen Street.
Wyllie, G. B.	" " King Street.
Young, Hon. John.	Montreal, C. E.
Young, Rev. Prof.	Toronto " Knox's College.

HONORARY MEMBERS, 4.

Lefroy, Lt. Col. J. H., R.A., F.R.S.	Sabine, Col. E.; R. A., F. R. S., &c.
Logan, W. E.; F. R. S., and G. S.	Stephenson, Robert (M. P.)

LIFE MEMBERS, 36.

Barron, F. W.	Parkes, Vincent.
Birchall, T. W.	Page, John.
Cameron, Hon. J. H.	Paterson, D.
Cayley, F. M.	Perrin, W. L.
Cotton, James.	Proudfoot, W.
Dixon, Joseph.	Perkins, George.
Duggan, George, Junr.	Robinson, Hon. Sir J. B. Bart.
Duggan, John.	Ridout, J. D.
Ewart, John.	Ridout, G. P.
Harris, T. D.	Ross, W. C.
Herrick, G. (M.D.)	Rowsell, H.
Hincks, Hon. F.	Scadding, Dr. H.
Hutcheson, John.	Smith, Larratt, W. (D.C.L.)
Kneeshaw, Richard.	Smith, J. F.
Mitchell, James.	Stennet, W.
Monro, George.	Thomas, W.
Murray, Alexander.	Thompson, S.
McCord, A. T.	Vankoughnet, P. M.

JUNIOR MEMBERS.

Baldwin, Robert	Heyden, L. Junr.
Baldwin, M. S.	Mayer, S. D.
Battersby, Leslie	Murrney, E. H.
Beaven, E. W.	Murray, H. W. M.
Bogert, J. J.	M'Gregor, C. J.
Carter, Arthur	O'Brien, D.
Crombie, E. M.	Phillips, T. D.
Dartnell, G. H.	Ridout, J. G.
Davies, H.	Rykert, A. E.
Esten, J. H.	Simpson, A. W.
Fitzgerald, W. W.	Stewart, C.
Forneri, R.	Torney, Hugh
Gilbert, Jas.	Turner, Loftus
Hallan, S. W.	Wright, James

Honorary Members	4
Life Members	36
Members	440
Junior Members	28
Total	508

JAMES JOHNSON,
Assistant Secretary,
Canadian Institute.

Toronto, 31st December, 1855.

The Mastodon Giganteus

In 1852 I sent to the annals of natural history an account of the exhumation of some Mammoth bones in cutting through the drift at the head of Burlington Bay when forming the Great Western Railroad. This I believe was the first notice of the finding of the remains of any of the large extinct Proboscidians within the limits of this Upper Province; and I believe I am again to be the first to record the discovery of fragments of an individual of the allied genus Mastodon which I apprehend to be of the species most common in North America, the Mastodon *Giganteus.*

When at Niagara Falls last autumn my attention was called to some fossil bones in Barnett's museum. They consisted of a beautifully perfect lower jaw, one perfect vertebra, some others, and a rib partially destroyed by fire in consequence of having been thrown on a log heap when cleaning the land. I had been in hopes of visiting the spot where they were found before publishing this notice, but having been unable to do so, I will give Mr. Barnett's own discription of the locality:

"The jaw and other remains of the animal were dug up at a farm adjoining that of Mr Hugh Shanon in the Township of

Southhold, District of London C. W., on the 13th Nov. 1854.

"Where the bones were found is a swale of blackish peat two or three feet deep, beneath is a whitish grey clay. The bones had not been forced into the clay more than their weight had sunk them when the clay was in a soft state."

The single incisor in the lower jaw which Prof. Owen gives as a distinguishing mark of the M. Giganteus is beautifully preserved, the tip is worn and polished by the continued friction of the trunk; it does not seem to have protruded far beyond the integuments; the length of the tooth beyond the bone is about five inches.

The bones can be seen in Barnett's museum.

T. J. C.

Woodstock, Dec. 1855.

Suplementary Remarks

IN BEHALF OF THE ESTABLISHMENT OF A PROVINCIAL SYSTEM OF METEOROLOGICAL OBSERVATIONS.

BY MAJOR LACHLAN, MONTREAL.

Read before the Canadian Institute, January, 1855.

Although greatly disappointed in finding no action taken by the Canadian Institute to bring the important subject of the establishment of a Provincial System of simultaneous Meteorological Observations before the Legislature during the last session of Parliament, I still continue to regard the object aimed at as a desideratum of too much philosophical as well as public interest and value to be abandoned without a further effort in its behalf; and I therefore trust that I shall neither be accused of undue pertinacity nor self-conceit, in bringing the matter once more before the Association, in the hope that the additional arguments and information which I am enabled to advance in its favor will leave no difficulties whatever in the way of a successful movement before the next Session.

As a necessary preliminary to the observations about to be made, it requires to be borne in mind that my first paper on the establishment of Systematic Meteorological Observations throughout British America was read at the Institute so long ago as in April, 1854,* and that my Essay on the periodical Rise and Fall of the great Lakes, was presented in the following month; and that at the conclusion of the reading of the former it was moved by Professor Cherriman that the matter should be referred to the Council, and a select Committee appointed, in accordance with my wishes, to report on the same; and further, that at the next meeting that Committee was duly named; but that owing to some unfortunate or embarrassing circumstances, the only progress made by it during the remainder of that year was reporting, on the 2d December, that, "considering it necessary, before taking any special steps, to obtain information with reference to the working of a similar system in the United States, they had deputed Professor Cherriman to communicate with Professor Henry, of the Smithsonian Institution, on the subject; but that not having received the desired information, they were not yet prepared to take any special action."

Such continued to be the state of matters till the annual meeting of the Institute in January last, when our worthy President judged proper to bring the subject promptly forward in the annual Address in such strong, and to me very flattering, terms, that I naturally expected that immediate decisive action would follow. In this, however, I was disappointed, Parliament being prorogued five months afterwards without any further steps being taken.

Passing over some lengthy correspondence, which, took place in consequence, I shall here only observe that there appearing to me to have been some obstacle in the way of obtaining from Professor Henry the required information alluded to in the Committee's minute of the 2d December, 1854, I resolved to endeavor, if possible to ascertain what it was, by opening a correspondence with that gentleman myself; and this I accordingly did in the month of June last; and the result, I am happy to say, proved equally successful and satisfactory, I having lately been furnished, by Professor Henry, with nearly all the information I desired, in addition to being favored with a copy of a small volume containing seven of his successive annual Reports to the Smithsonian Institution, which supply many additional interesting particulars.

Deeming it unnecessary to enter into the details of the view all along taken by me of the great philosophical as well as public benefits to be derived from the adoption of my proposition, I am content to refer you to my article on the subject in the II. volume of the *Canadian Journal,* but more particularly to pp. 242 and 3, and to add here, in few words, that I looked forward to the Canadian Institute measures being in concert with the Smithsonian Institution, in fact, adopting the same system, and embracing the same objects as are now successfully carried out in the United States under the direction of that jurisdiction, with the sole addition of a systematic Registry of the periodical rise and fall of the great Lakes; and that it appeared to me that branches of the undertaking, though resting mainly on a philosophical foundation, were, in a provincial point of view, so decidedly and essentially of a useful and beneficial *public* character that, if appealed to, our government would not hesitate to bear a part in the promotion of them,—and the more so, as forming important necessary links in a great chain of valuable philosophical researches in physical geography now in progress *all over the world.* I, however, considered that the Parliamentary assistance might in the first instance be limited to granting an appropriation sufficient to meet the expense of furnishing a set of well adjusted Instruments for each Station of Observation, and authorizing all such public officers as Harbour Masters, Light-House keepers, and Collectors of Customs, to give their valuable assistance; and that the Commander of the Forces should at the same time be solicited to aid the undertaking, by requesting all Medical Officers in charge of Hospitals to furnish to the Institute a copy of the Meteorological Record transmitted periodically to the Inspector General in London; and that the valuable co-operation of the Governor of the Hudson's Bay Territory should not be overlooked; and further, that every University, College, and other Educational Institution, together with every Literary and Philosophical Society, and every Mechanics Institute, throughout the Province should be invited to lend their assistance; and finally, that the co-operation of the Governments of Nova Scotia, New Brunswick, and Prince Edward's Islands should be invoked in the laudable work.

These, it may be said, are, at best, only the opinions of a single individual; but that much more is required. I have, therefore, the pleasure of adding that they have been encouraged and confirmed by not only your late distinguished President Lieut. Col. Lefroy, and experienced Canadian Meteorological observers, such as Doctors Smallwood, and Craigie, and others, on the one hand, and the talented and energetic Secretary of the Smithsonian Institution at Washington on the

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* The Canadian Journal of March, 1854.

other; but also by the harmonious action manifested in behalf of the same great object by not only various Literary Societies and governments in the United States, as well as by the friends of Science in almost every Kingdom and State in Europe; added to the acknowledged valuable results of the extensive chain of Meteorological Researches so long liberally carried on in Asia, under the auspices of the East India Company's Government. But, in short, it appears to me that all that *should* be wanting to ensure an immediate effectual appeal to our own Government in behalf of such an object is to point out in few words what has been so creditably accomplished by our American neighbors alone; and that, I conceive, cannot perhaps be done better than in the language of Professor Henry's 6th Report to the Smithsonian Institution, being that for 1852, (though many improvements and additions have since taken place,) in the hope that the Canadian Institute will be permitted to have the honor of standing in the same relation to the British American Provinces as the Smithsonian Institution does to the great American Union.

According to the document alluded to, the general system of Observations relating to the Meteorology of the Continent of North America, described in previous Reports, had been continued and extended, and then (in 1852) consisted of the following classes:

" 1st. *The Smithsonian System proper*, made up of voluntary Observers in different parts of the United States, who report immediately to the Institution.

" 2d. *The System of Observation of the University of the State of New York*, re-established under the direction of this Institution, and supported by the State of New York.

" 3d. *The System of Observations established* under the direction of this Institution, by the State of Massachusetts.

" 4th. *The extended System of Observation made at the several Military Posts of the United States*, under the direction of the Surgeon General of the Army.

" 5th. *Separate Series of Reports of Observations by exploring and surveying parties*, in some cases directed, and in part furnished with Instruments by this Institution.

" 6th. *Meteorological Records from British America*, consisting of Observations made at the various posts of the Hudson Bay Company, and at the residence of private individuals in Canada.

" In the first three of these classes there are about 200 (since increased to upwards of 300) Observers, distributed over the entire Continent. In the older States they are very thickly distributed, and they are entirely wanting in none.—Texas, Arkansas, the Indian Territory, (Indiana) Missouri, Iowa and Minnesota, have each competent and reliable Observers, reporting directly to the Smithsonian Institution, in addition to those at the Military posts in the same region.

" Further Westward, and more widely separated, the Observers at the Military posts, and those of surveying and exploring parties continue the connection of the System to the Pacific Coast, where the number of Military posts is greater, and private Observations are again found.

" The New York State System embraces 25 (now 38) Academies or Stations, all furnished with new and reliable Instruments, *at the expense of the State.*

" In Massachusetts twelve Stations are furnished with Instruments *in like* manner, of which eight have reported.

" In 1852 ninety-seven Military posts reported Meteorological Observations; and for 1853 the number will be greater rather than less.

" The whole number of Stations and Observations available for 1852 were 350; and this number, either reporting directly to the Institution or furnishing their Observations for its use, may be relied upon for the current, year *i. e.*, 1853.

" Besides the Observations derived from this general System, a large collection has been procured from individuals in different parts of the country who have kept records of the weather, in some cases for many years. *This was obtained by issuing a Circular from the Institution requesting copies of any records which might have been kept relative to the Climate of the Country.* The amount of information received in answer to this Circular was far greater than was expected; *and much more valuable matter was thus called forth than was previously known to exist.*"

To the foregoing interesting sketch it is proper to add that I glean from other sources that the first appropriations devoted by the Smithsonian Institution to the advancement of Meteorological Research amounted to $1,000, and took place in 1848, the year after its foundation, and that it has ever since continued to allot from $2,000 to $3,000 annually to the same purpose; but that the State of New York led the way in so meritorious a work no less than thirty years ago, by an annual public grant, enabling the Regents of the State University to make an appropriation for supplying each Academy with the necessary Instruments, and that about five years ago it was enlarged, and the System re-organized, and committed to the regulation of the Smithsonian Institution; and further, that the State of Massachusetts had of late years made a similar appropriation and adopted a similar arrangement, as regards the Smithsonian Institution; and that several other States were following the same laudable examples. In contrast to which I regret to say that though Professor Henry had, in correspondence with Colonel Sabine, the eminent corresponding Secretary of the Royal Society of Britain, been assured, so long ago as 1847, that as soon as a System of Meteorological Observations should be organized in the United States there would be no difficulty in establishing corresponding Observations in the British American Provinces, and he had been encouraged in the same hope by Captain Lefroy. The only regular contributions of importance that appear to have been received from those Provinces, until very lately, have been the Meteorological and Magnetic Observations at the Toronto Observatory, and those by Doctor Smallwood at St. Martin's and Dr. Hall and L. A. L. Latour of Montreal, and Henry Poole, Esq., of Picton, and T. S. Stewart, Esq., of Acadia College, Nova Scotia. Whereas the following abstract Table, framed by me from authentic returns, will show the great number of Observers reporting to the Smithsonian Institution from the different States in the Union in the year 1854:

Abstract number of Meteorological Observers in the different States of the Union, reporting to the Smithsonian Institution in 1854.

Maine,	8	Mississippi,	5
New Hampshire,	7	Louisiana,	2
Massachusetts,	21	Texas,	3
Vermont,	7	Tennessee,	8
Rhode Island,	4	Kentucky,	8
Connecticut,	6	Ohio,	24
New York, (beside Univ'ty)	31	Michigan,	13
New Jersey,	5	Indiana,	10
Pennsylvania,	24	Illinois,	7
Delaware,	2	Missouri,	3
Maryland,	6	Iowa,	8
Virginia,	13	Wisconsin,	13
North Carolina,	4	Minnesota,	6
South Carolina,	4	Oregon,	1

Georgia,	6	California,	3
Florida,	5	Nebraska,	1
Alabama,	7		

It must also be added that while in the published list of Foreign Literary Associations in correspondence with the Smithsonian Institution in 1854, I see in Sweden the names of ten, in Norway five, in Iceland one, in Denmark six, in Russia sixteen, in Holland fourteen, in Germany one hundred and six, in Switzerland fifteen, in Belgium ten, in France sixty-five, in Italy thirty-five, in Portugal one, in Spain four, in Great Britain and Ireland ninety, in Greece one, in Turkey twenty-one, in Africa three, in Asia eleven, in Van Diemen's Land two, and in various States in Central and South America seventeen, I do not observe the name of a single Library Association throughout the whole of the British American Provinces and West Indies! although I learn that a proposal was made by the Smithsonian Institution to memorialize the Canadian Government on the subject so far back as 1851. Why, or how, such should be the case it is not for me to account.—It is sufficient to state the rather startling fact; and I am the more induced to do so, from bearing in mind that it was to the Cosmopolitan liberality of a Briton, who, in his own words, regarded "the man of science as of no country; the world his country; and all men as his countrymen," that the United States are indebted for the foundation at Washington of the noble philosophical "*Establishment for the increase and diffusion of knowledge among men,*" now known by the name of the *Smithsonian Institution.* It is at the same time proper to add that copies of the different published volumes of the "*Smithsonian Contributions*" have very lately been presented to the Natural History Society of Montreal, and it may therefore be presumed that a similar liberal donation has been extended to other literary societies in the Province; and if so, the greater the obligation to endeavor to make some suitable return.

Wishing to encroach as little as possible on the time of the Institute, I beg, in conclusion, to refer the members to the subjoined copy of a highly satisfactory and instructive letter lately received from Professor Henry in reply to more than one communication from me, and to be allowed to add that should any further information be required by the Council, I shall be happy to be the medium of obtaining it, without the necessity of resubmitting the matter to any special committee. And, in the meantime I may be permitted to add here, that in my original paper I ventured to name twenty-six places, as stations of Observation in Canada, between Gaspé and the western extremity of Lake Superior; but that this number might perhaps require to be considerably increased. As, however, the enlightened foresight of the excellent Superintendent of education in Western Canada has already in a great degree met that want, by allotting a set of Meteorological Instruments to each County Grammar School, the number required in that section of the Province would be thereby materially diminished; and should a similar regulation be established in Eastern Canada the same would be the result there. Say, however, that twenty-five extra Stations were required in each section of the Province, the expense of supplying Instruments for the whole, estimated by Lieut. Col. Lefroy at so low as £10 each, but stated in detail by Professor Henry at not less than £30 each, would at the most be £1500 at the outset; and the allowance to fifty Observers, estimated at a medium rate between those granted by the Legislatures of New York and Massachusetts, or say 40 dollars each, would require at most an annual grant of £500 more.

Let Canada set the example of allowing this moderate yet, I am disposed to think, sufficiently liberal fund to the advancement of so laudable a National Work, and recommend a similar line of conduct to the favorable consideration of the Sister Provinces, and I am confident that triumphant success will be the speedy result.

(Copy) Smithsonian Institute,
Washington, 24th Oct., 1855.

DEAR SIR,—I regret very much that your letters in reference to Meteorology had not met with a more prompt reply. Your first letter failed to reach us; and the second informed us that a printed Pamphlet had been sent; and we delayed our answer in full until we had an opportunity of reading it. It did not, however, come to hand till I was on the point of leaving the city to be absent a number of weeks, and I now embrace the first opportunity since my return to give you the promised information. I hope that, though my letter has in consequence been delayed, it will be in time to answer your purpose in regard to an application for aid from Parliament for establishing a Meteorological Register in Canada.

1st. A series of observations simultaneous with those in the United States would not only be of much local interest in determining the character of the climate in different parts of Canada, but of high scientific importance in ascertaining the laws of atmospheric changes peculiar to the North American Continent. The system of winds which prevail in this Continent can never be properly understood until a series of simultaneous observations are made at intervals from the Gulf of Mexico to near the arctic circle; and no greater favour could be conferred on the science of Meteorology than the establishment of a series of observations in the British possessions in North America. If this were done, all the phases of a winter's storm could be noted from the moment of its rise through all its changes, until its disappearance; and for want of data of that kind, the observations now made within the boundaries of the United States are of much less value than they otherwise would be.

2. In answer to your *first* question,—"*What course in Canada would be most in accordance with the measures already in progress in the United States under the auspices and direction of the Smithsonian Institution?*" As to the course to be pursued in bringing about so desirable a result; I would suggest, what has already occurred to yourself,—that aid be asked by the Canadian Institute from Parliament, and the Hudson's Bay Company to procure the necessary instruments; that intelligent persons who have a taste for science, residing in different parts of the country be invited to co-operate; that observations be made at all military and trading posts; and that the Returns be reduced and published under the direction of the Canadian Institute, as fully as the means which may be obtained would warrant; that the original manuscripts should be preserved in the archives of the Institute, in order that they may be examined in studying the motion of atmospheric waves, and in tracing the progress of storms.

3. In answer to your *second* question:—"*What number of stations or posts of observation (without reference to those proposed by me) would it be desirable to have established in the British American Provinces: and what particular places would the Smithsonian Institution recommend as best adapted for such purposes?*" I would state that it would be desirable to establish as many stations as can be supported, and that a corps of observers be established, though they have no other instruments than the wind vane and rain gauge. In case a

limited number of observers can be supported, it will be well to distribute these as uniformly over the space as may be practicable. It would be desirable that no two be further apart than 100 miles. At present, without a critical examination of the map I am unable to suggest any place of paramount importance.

4th. In regard to your *third* question:—"*What are the instruments now in general use throughout the United States; by whom made and adjusted, and their respective prices; and what is the average expense to the public at each Station?*" I have to inform you that the instruments now in use throughout the United States are the *Barometer, Thermometer, Psychrometer, Wind vane* and *Rain gauge*, made under the direction of the Smithsonian Institute, by James Green, 422 Broadway, New York. They are compared with standards from London and Paris. The Barometer is furnished with an adjustable cistern, and the scale is so arranged as to eliminate the necessity of a correction for capillarity, and the instruments are reliable, and will serve for ascertaining absolute quantities as well as for indicating relative atmospheric changes. The prices are—for a barometer, $35; thermometer, $5; psychrometer, $6 75; rain gauge, $3. All the observations made under the direction of the Smithsonian Institution are voluntary and gratuitous; the observers under the direction of the State of New York receive $50 per annum; and those for the State of Massachusetts, $25.

5th. In answers to:—"*are there regular printed forms of Registry, common to all, and can we be furnished with copies?*" The Smithsonian Institute prepares and distributes regularly printed forms of registry, which are used by observers generally throughout the United States, which might be copied for distribution by the Canadian Institute.

6th. In answer to the *fifth* inquiry:—"*Are there any printed instructions for observing, with the view of ensuring a thorough uniformity with the times, method, and language of registration throughout the whole chain of operations?*" Our edition of instructions to observers is exhausted, but another will be published for distribution at the beginning of the year. A new edition is also in the hands of the Stereotypers of the tables necessary for reduction.

7th. Besides operations with meteorological instruments, much valuable information may be derived from the registration of periodical phenomena, such as the first appearance of different animals, the flowering and maturing of different plants. Blank forms for registering those have also been prepared by this Institution.

Accompanying this, we send you a copy of the 7th and 8th Report of the Smithsonian Institution, from which much additional information may he obtained in regard to our meteorological system.

I remain, very respectfully, your obedient servant,

(Signed) JOSEPH HENRY,

Secretary of the Smithsonian Institute.

To Major Lachlan, Montreal.

REPORT OF EDITING COMMITTEE ON MAJOR LACHLAN'S SUPPLEMENTARY REMARKS.

The Editing Committee, to whom Major Lachlan's "Supplementary Remarks in behalf of the Establishment of a Provincial System of Meteorological Observations," were referred, beg to report, that, while appreciating the persevering zeal of the author, his communication appears to them calculated to convey an erroneous and unjust impression of what has been done, and is now doing, in Canada; as well as of the conduct of the Institute in declining to adopt his recommendation of an immediate application to Parliament, for a grant of money, to establish a Provincial System of Observation. The Institute was aware that already, by Act of Parliament, this object had, in great part, been attained by a provision that Meteorological Observations should be regularly made at the various Grammar Schools in the Upper Province, and that the organizatian of this system was satisfactorily in progress. When completed, the Institute might be prepared to take steps for the establishment of supplementary stations, where needed; but meanwhile, the application urged by Major Lachlan seemed unnecessary, and, indeed, impracticable, till the number of such supplementary stations could be ascertained. The Institute would also have been at a loss to name the sum to be applied for from Government, on account of the difficulty of estimating one most important and indispensable item, which would appear to have been entirely overlooked by Major Lachlan, viz., the provision of a staff of assistants for the purpose of abstracting, reducing, and preparing for publication, the returns transmitted from the different stations. Information on this head was sought in vain from the experience of the system in the United States, superintended by the Smithsonian Institution. The various details of that system, quoted in Major Lachlan's communication, were well known to members of the Institute interested in this subject; but with regard to this item—the most important of all—no information was obtained from the Smithsonian Institution, nor could be, since it is only within the last few weeks that that body has announced that their arrangements for this purpose have at length been completed.

It appears that the subject of Meteorological Observations in Canada, so far from being neglected, is at present receiving a very considerable share of attention. Only a few months have elapsed since arrangements were completed for placing the Magnetic and Meteorological Observatory on the foundation of Toronto University, and others are under consideration, and have already received the sanction of his Excellency the Governor-General, for providing a staff of educated observers, from the same fund, to be attached to the Observatory as University Scholars. In connexion with this, and in furtherance of the same objects, by a statute of the Council of University College, a Chair of Meteorology has been established in that Institution, and the new Professor, G. T. Kingston, Esq., M.A., will deliver his first course of lectures during the present term, specially designed for training Grammar School Teachers, the Pupil-Teachers of the Normal School, and others, in the use of the requisite instruments, and the scientific application of the results aimed at in such observations.

Finally, the correspondence between Lieut.-Col. Lefroy and the Rev. Dr. Ryerson, in reference to the immediate establishment of thirty stations in Upper Canada, in connection with the Grammar Schools, is in the press, and will be published in a few weeks; and it appears to the Committee, that if anything further is to be done at present, the Institute should limit itself to recommending to the Government the application of the same principle in relation to the Grammar Schools and other educational Institutions of Lower Canada, which is now being brought into successful operation in this section of the Province.

In carrying out the plans already matured or projected, the Committee beg leave to express their opinion that the duties of the Canadian Institute should be strictly limited, as heretofore, to publishing the Observations. The idea of a voluntary association, constituted like the Canadian Institute, undertaking

such duties as are performed by the official staff of the richly-endowed Smithsonian Institution of Washington, is altogether fallacious, and could only lead to disappointment and failure. That portion of its members on whom such duties must devolve, are already called upon to make considerable sacrifices in time and labour, for the successful conduct of the Institute; and if a staff is to be provided, for carrying out such a comprehensive scheme as they trust ultimately to see established in British North America, the Provincial Magnetic and Meteorological Observatory is the only Institution to which it can be proper to have it attached.

CANADIAN INSTITUTE, Jan. 22d, 1856.

MEMORANDUM:

On the steps which have been taken by the Educational Department, to establish a system of Meteorological Observation throughout Upper Canada.

(*Read before the Canadian Institute, Jan.* 26, 1856.)

BY J. GEORGE HODGINS, DEPUTY SUPERINTENDENT OF SCHOOLS.

As some doubt seems to exist on the minds of some of the members of the Institute, regarding the nature and extent of the means which have been employed to establish meteorological stations throughout Upper Canada, I have deemed it proper to embody in this memorandum, all the information in the possession of the Department of Public Instruction on the subject.

By some of the members it has been felt, that the Institute is liable to censure for not taking the initiative in the matter; and proceeding at once to give practical effect to certain views on the subject, which had frequently urged upon it; but had those gentlemen applied either to Professor Cherriman, or to the Chief Superintendent of Schools, they might have learned what was the nature of the steps which had been taken to carry out an effective system of meteorological observation throughout Upper Canada.

It it now six years, since the subject engaged the attention of our second President, Col. Lefroy. At his suggestion, Dr. Ryerson submitted the matter to the Government; and in June, 1850, a Bill was brought into the Legislature by the Hon. Francis Hincks, containing among other things the following proposed enactments:—

"Whereas it is desirable at Seminaries and places of Education to direct attention to natural phenomena, and to encourage habits of observation; And whereas a better knowledge of the climate and meteorology of Canada will be serviceable to agriculture and other pursuits, and be of value to scientific enquirers: Be it therefore enacted, That it shall be part of the duty of the Master of every Senior County Grammar School, to make the requisite observations for keeping, and to keep, a Meteorological Journal, embracing such observations, and kept according to such form, as shall from time to time be directed by the Council of Public Instruction; and all such Journals or Abstracts of them shall be presented annually by the Chief Superintendent of Schools to the Governor, with his Annual Report:

Every senior county grammar school shall, on or before the last day of November, one thousand eight hundred and fifty-four, be provided, at the expense of the county municipality, with the following instruments:

One barometer.

One thermometer for the temperature of the air.

One Daniel's hygrometer, or other instrument for shewing the dew-point

One rain-guage and measure.

One wind-vane.

And it shall be the duty of the Chief Superintendent of Schools to procure these instruments at the request and expense of the Municipal Council of any county, and to furnish the master of the senior county grammar school with a book for registering observations, and with forms for abstracts thereof, to be transmitted to the Chief Superintendent by such master, who shall certify, that the observations required have been made with due care and regularity."

It was much to be regretted that, owing to the pressure of other matters, this Bill only reached a first reading before the Legislature adjourned.

In 1851, the Seat of Government was removed to Quebec; and it was not until midsummer, in 1853, that Dr. Ryerson, with the assistance of the Hon. Mr. Hincks, succeeded in getting a bill passed, containing a provision in the identical words just quoted. The year 1854, was chiefly occupied in devising measures for re-organizing the Grammar Schools, and in placing them in a more satisfactory footing in the country. In that year, however, specimens of the instruments designed to be used in making the necessary observations, were procured by Dr Ryerson in Boston, and New York. I have brought some of these instruments down for your inspection; they are now before you on the table. Upon examination, early in 1855, by Professor Cherriman, (who has kindly aided the Chief Superintendent in this matter) the instruments were considered unsuitable. A second order for instruments, to a London maker, not having been completed in time for establishing the stations in 1855, Dr. Ryerson determined to take no further steps in the matter, until he would visit London and Paris, and with the aid of Col. Lefroy, select such instruments as would be suitable for his purpose. This he has been enabled to do in a most satisfactory manner, as will be seen by the following extract, from a letter on the subject dated the 20th of November last, and addressed to the Secretary of the Province.

Dr. Ryerson says:—"After my arrival in London, I conferred with Col. Lefroy, on the subject of procuring philosophical instruments for the Grammar Schools. Col. Lefroy, so long and favourably known in Canada—with whom the provision of the Grammar School Act originated, (and who had promised, at the time of its adoption, to give me the benefit of his experience and practical knowledge, in giving it effect,) readily aided me by his counsel and advice. I found, on inquiry, and the comparison of catalogues, that some of the instruments could be procured more cheaply in Paris, while it was more advisable to get others made in London. At length Messrs. Negretti & Zambra, (the London manufacturers of philosophical instruments,) agreed to furnish all the instruments required, as low as they could be obtained in Paris, to mark the thermometer according to both the centigrade and Fahrenheit systems, and to make them range as low as 35 degrees below zero; to test all the instruments before packing them, and to deliver them in New York, to a brother of Mr. Negretti, at their own risk—I only to pay the freight. I beg to append to this letter, (marked A) the admirable memorandum with which Col. Lefroy kindly furnished me in London, on the subject of those instruments; and I am happy to be able to add, that Professor Cherriman, (who succeeded Col. Lefroy in the Observatory at Toronto,) has cordially consented to afford me all the aid I may require in the preparation of the tables and instructions necesaary to render the system of Meteorological Observations, adopted in the Senior County Grammar Schools, harmonious with that adopted at the Provincial Observatory, and to prepare and transmit the proper returns. Messrs. Negretti & Zambra cannot execute the order for the whole of these instruments, (40 sets, which will be made under the inspection of Col. Lefroy), until February. The cost of the instruments will be from £12 to £15 per set. The system of meteorological observations in Canada, when once established, will be more complete than that of any other part of America."

The memorandum referred to by Dr. Ryerson, I have


OUTLINE MAP OF
UPPER CANADA
Showing the proposed
METEOROLOGICAL STATIONS
in connexion with the
GRAMMAR SCHOOLS
To illustrate Mr. Hodgins' paper, read 26th January, 1856 before the Canadian Institute
• Senior Grammar Schools, and Chief Stations
× Junior Grammar Schools, and additional Stations (if necessary)
□ Proposed Grammar Schools.
LAKE HURON
GEORGIAN BAY
LAKE ONTARIO
LAKE ERIE
UNITED STATES
Owen Sound
Barrie
Bond Head
Newmarket
Richmond Hill
Uxbridge
Whitby
Lindsay
Peterborough
Norwood
Bowmanville
Port Hope
Cobourg
Colborne
Brighton
Trenton
Stirling
Belleville
Consecon
Demorestville
Picton
Napanee
Newburgh
Bath
Kingston
Brockville
Prescott
Kemptville
Matilda
Perth
Smiths Falls
Lanark
Carleton Place
Richmond
Ottawa
Renfrew
L'Orignal
Vankleekhill
Williamstown
Cornwall
TORONTO
Brampton
Streetsville
Milton
Oakville
Elora
Guelph
Berlin
Galt
Dundas
Hamilton
Ancaster
Brantford
Paris
Woodstock
Stratford
Goderich
Port Sarnia
London
Carradoc
St. Thomas
Fingal
Vienna
Simcoe
Caledonia
Cayuga
Beamsville
St. Catharines
Niagara
Merrittsville
Chatham
Sandwich
Maclear & Co. Lith. Toronto.

brought down for the information of the members, should they desire it.

In connection with this extract, it may be gratifying to know, that the Governor General highly approves of the contemplated arrangements, and has commissioned Dr. Ryerson to convey to Col. Lefroy, His Excellency's acknowledgments and thanks for his very valuable assistance in this matter.

The outline map of the Counties, exhibited to-night,* and which I have had specially prepared to accompany this memorandum, is designed to shew at a glance, the number and position of the proposed meteorological stations throughout Upper Canada. The position of the Senior County Grammar Schools is indicated on the map by a large black circle—Toronto, the chief and central station, being prominently marked. These will be for some time the principal stations; but as circumstances warrant, the Junior Grammar Schools, will, no doubt, become stations of equal importance and value with the others. I have indicated the position of these junior stations by a black cross. Some additional chief stations, which will be established when the now united counties become separated, I have marked with a square black figure. We have therefore :—

Contemplated Chief Stations	30	
Additional Chief Stations	3	
Junior Stations	40	
Total Stations		— 73

From the junior stations it will be seen what are our resources should it be deemed advisable to multiply the Chief Stations and extend our system of observation still further throughout Upper Canada. No time, however, will be lost in establishing the Chief Stations; and it is hoped, that before the close of the present year, many of them will be in successful operation.

These facts and illustrations which I have presented, exhibit in detail, perhaps a little too minutely, all the information which is in the possession of the Department of Public Instruction on the subject. They show, conclusively, that the gentlemen at the head of that Department has never lost sight of the great practical importance, to a new and but partially settled country, of establishing (early in its history,) before its physical condition is materially changed, a complete and comprehensive system of meteorological observation, by which may be tested theories in Physical Science, which are yet unsettled; and by which may be solved questions relating to Natural Phenomena, which have long remained among the sealed mysteries of Nature.

* A reduced copy of this Map is published herewith.

Montreal Natural History Society.

An ordinary meeting of this Society was held in the Museum on Monday evening November 26,—the President, the Lord Bishop of Montreal in the Chair. There were present Drs. Workman, Fraser, Scott, Hingston, Barnston, and Messrs. Henshaw, H. J. Ibbetson, Dutton, and Rennie.—The minutes of last ordinary meeting were read over and approved.—Read a letter from Dr. Hall accompanying his meteorological observations during the last three months which he presented to the Society for preservation in its records.—Ordered that the donation be acknowledged with thanks, and that Dr. Hall be requested to continue his contribution.—The last report of the Upper Canada Board of Agriculture was laid on the table.—Application having been made for a loan of some of the specimens contained in the Museum to enable Mr. Principal Dawson to illustrate the course of lectures upon Natural History he is now engaged in delivering at McGill College, it was, Resolved, That upon receiving a list of the specimen's required, and the Principal's obligation to return the same, the Society are willing to accede to his request provided the Cabinet Keeper is satisfied that they can with safety be removed.—The meeting then proceeded to ballot, when the Rev. A. Kemp, Minister of St. Gabriel Street Church was unanimously elected an ordinary member. Several gentlemen were proposed as ordinary members; after which the meeting separated.

A. N. Rennie, *Recording Secretary.*

The British Association for the Advancement of Science.

On Alloys of Iron and Aluminum.—By Prof. F. C. Calvert.—Professor Calvert, in conjunction with Mr. Richard Johnson, has succeeded in producing a great many new alloys, having a definite chemical equivalent composition, and, therefore, bringing a large class of products, called alloys, into the general laws of the present day—Chemistry, the law of definite proportions or equivalents. These gentlemen have succeeded in preparing the following alloys of iron and potassium: *First Alloy*—4 equivalents of iron; 1 equivalent of potassium. *Second Alloy*—6 equivalents of iron; 1 equivalent of potassium. These alloys were prepared with the view of solving one of the great chemical and commercial questions of the day—namely, that of rendering iron less oxidable when exposed to a damp atmosphere, as these gentlemen believe that no kind of coating can be discovered which will resist the constant friction of water, as is the case with iron steamers. But all the alloys which they have produced up to the present time, with the exception of one, are oxidable, although some of them contain as much as 25 per 100 of potassium, the most electro-positive metal known, and the one most likely to render iron in that electro-chemical state, and less liable to combine with oxygen, the above alloys of potassium and iron were remarkable for their great hardness. They have also succeeded in producing two new alloys composed of iron, combined with that most valuable and extraordinary metal, aluminum, lately obtained by Mons. St. Claire Deville. These two alloys are composed as follows: *First Alloy*—1 equivalent of aluminium; 5 equivalents of iron. *Second Alloy*—2 equivalents of aluminium; 3 equivalents of iron. The last alloy presents the useful property of not oxidizing when exposed to a damp atmosphere, although it contains 75 per cent. of iron. The following alloys were also described, one composed of 1 equivalent of aluminium, and 5 equivalents of copper; one other of iron and zinc, composed of 1 equivalent of iron and 12 equivalents of zinc; and what is interesting respecting this last alloy is not only its extreme hardness, but that it is produced at a temperature of about 800°, it being formed in a bath of zinc and iron containing 14 tons of metal, and through which iron wire is passed when coated with zinc or galvanised. Messrs. Calvert and Johnston took advantage of having such a large melted mass of metals (zinc and iron) to inquire into the following question, viz., if two metals, when melted together, separate according to their respective specific gravity or form a homogeneous mass combined in definite proportions. They consequently analysed three samples taken from the melted bath, one near top, one in the middle, and one at the bottom. Strange to say, they all presented a different composition, and what is not less remarkable, is, that the upper layer contained the largest proportion of the heaviest metal. These three samples offered the following equivalents and definite compositions:—*Top*—1 equivalent of tin, 11 do. of zinc. *Middle*—1 equivalent of tin, 16 do. of zinc. *Bottom*—1 equivalent of tin, 19 do. of zinc. It would appear from their researches, that by preparing commercial alloys according to fixed scientific rules, instead of mere routine, they hope to produce for commerce cheaper alloys than those now in use. The action of acids on these alloys of copper, zinc, &c., presents this curious fact, viz., that although hydrochloric acid affects violently zinc and tin, still in alloys containing these metals with copper, they are but very slightly attacked by this powerful acid. Similar results were also obtained by sulphuric and nitric acids.

On Some of the General Mechanical Structures of Limestone.—By H. C. Sorby, F.G.S.—The author considers that the only satisfactory method of ascertaining the structure of limestones is to examine thin sections of them with the microscope. The results described in this paper were arrived at in this manner. Limestones have been usually described as more or less crystalline or earthy, but this has reference chiefly to subsequent changes, and not to their original condition. When examined with the microscope, it is seen that to describe them according to their mechanical characters would usually be far better. In this manner they may be very conveniently classed as organic sands or clays, in the same way that we may speak of felspar sand or clay. The organic structure of the minute fragments of which they are composed is often so well preserved, that their nature and relative proportions can be satisfactorily determined. When they have been consolidated, the shrinking of the mass has often produced cracks and joints, after-

wards filled with calcareous spar, and often presenting a beautiful appearance when examined with the microscope, on account of their number and regularity, and showing faults of 1-100th of an inch, or much less. These are totally distinct from slaty cleavage, which can be studied to great advantage in such limestones as have that structure. The author has proposed a theory to account for this, and has shown, that the rocks that possess it have been so much compressed, as shown by a great variety of facts, that the positions of their ultimate particles would be changed in such a manner as give rise to precisely such structure as that which produces cleavage. That this would be a necessary result may be proved both by calculation and experiment. In the case of limestones, it is impossible to suppose that any other than a mechanical cause can have developed the structure seen with the microscope, because the particles whose position has been changed are fragments of organic bodies, and not crystals. Besides this change of position, in many cases minute organic fragments, whose original form and structure are well known, are greatly compressed in the plane of cleavage, as shown by the change in their form and structure; and even crystals of dolomite are broken up, elongated, and their crystalline cleavage planes bent, thus showing that the rock was in a consolidated condition when the change of dimensions occurred, but that the pressure was so intense, and acted so gradually, that the whole mass of rock gave way like iron malleable substances, by the movement of the particles one over another.

On Aurora Borealis.—By Admiral Sir JOHN ROSS.—The communication I had the honor of making to the British Association at Belfast, on the interesting subject of the Aurora Borealis, being verbal, and therefore not entitled to a notice in the Association's valuable transactions of that period; but having subsequently repeated the experiments I then verbally mentioned, I can now confidently lay the account of them before the public, trusting that, when taken into consideration, they will be found corroborative of the theory which I published in the year 1819, and which led to a controversy that shall be hereafter mentioned. It having occurred to me that if my theory was true, namely, "That the phenomena of the aurora borealis were occasioned by action of the sun, when below the pole, on the surrounding masses of colored ice, by its rays being reflected from the points of incidence to clouds above the pole which were before invisible," the phenomena might be artificially produced; to accomplish this I placed a powerful lamp, to represent the sun, having a lens, at the focal distance of which I placed a rectified terrestrial globe, on which bruised glass of the various colours we had seen in Baffin's Bay was placed, to represent the coloured Icebergs we had seen in that locality, while the space between Greenland and Spitzbergen was left blank, to represent the sun. To represent the clouds above the pole which were to receive the refracted rays, I applied a hot iron to a sponge, and, by giving the globe a regular diurnal motion, I produced the phenomena vulgarly called the "Merry Dancers," and every other appearance exactly as seen in the natural sky, while it disappeared as the globe turned, as being the part representing the sea to the points of incidence. In corroboration of my theory, I have to remark that, during my last voyage to the Arctic Regions (1850-51), we never, among the numerous icebergs, saw any that were coloured, but all were a yellowish white; and, during the following winter, the aurora was exactly the same colour; and, when that part of the globe was covered with bruised glass of that colour, the phenomena produced in my experiment was the same, as was also the Aurora Australis, in the Antarctic regions, where no coloured icebergs were ever seen. The controversy to which I have alluded, was between the celebrated Professor Schumacher of Altona, who supported my theory, and the no less distinguished M. Arago, who, having opposed it, sent M. Gimard Martens and another to Hammerfest, on purpose to observe the aurora and decide the question. I saw them at Stockholm on their return, when they told me their observations tended to confirm my theory; but their report being unfavorable to the expectations of M. Arago, it was never published, neither was the correspondence between the two Professors, owing to the lamented death of Professor Schumacher. I regret that it is out of my power to exhibit the experiments I have described, owing to the peculiar manner in which the room must be darkened, even if I had the necessary apparatus with me; but it is an experiment so simple that it can easily be accomplished by any person interested in the beautiful phenomena of the Aurora Borealis.

Process for obtaining Lithographs by means of Photography.—Professor Ramsay, F.R.S., of Glasgow, described a process by which Mr. Robert Macpherson, of Rome, had succeeded in obtaining beautiful photo-lithographs,—specimens of which had been hung up in the Photographic Exhibition in Buchanan-street. The steps of the process are as follows:—

1. Bitumen is dissolved in sulphuric ether, and the solution having been mixed with a small quantity of some soapy substance, is poured upon a lithographic stone previously placed upon a levelling stand. The ether quickly evaporates and leaves a thin coating of bitumen spread uniformly over the stone. This coating is sensitive to light, a discovery made originally by M. Niepce, of Chalons.

2. A negative on glass or waxed paper is applied to the sensitive coating of bitumen, and exposed to the full rays of the sun for a period, shorter or longer according to the intensity of the light, and a faint impression on the bitumen is thus obtained.

3. The stone is now placed in a bath of sulphuric ether, which almost instantaneously dissolves out the bitumen which has not been acted upon by light, leaving a delicate picture on the stone, composed of the bitumen on which the light has acted.

4. The stone after having been carefully washed, may be at once placed in the hands of the lithographer, who is to treat it with gum and acid, after which proofs may be thrown off by the usual process.

Professor Ramsay then proceeded to state that the above process, modified, had been employed with success to etch plates of copper or steel:

1. The metal plate is prepared with a coating of bitumen precisely in the manner described above.

2. A *positive* picture on glass or paper is then applied to the bitumen, and an impression is obtained by exposure to light.

3. The plate is plunged into a bath of ether, and the bitumen not acted upon by light is dissolved out. A beautiful negative remains on the plate.

4. The plate is now to be plunged into a galvano-plastic bath and gilded. The gold adheres to the bare metal, but refuses to attach itself to the bitumen.

5. The bitumen is now to be removed entirely by the action of spirits and gentle heat. The lines of the negative picture are now represented in bare steel or copper, the rest of the plate being covered with a coating of gold.

6. Nitric acid is now applied as in the common etching process. The acid attacks the lines of the picture formed by the bare metal, but will not bite the gilded surface.

Thermogenic Apparatus.

For some time past there has been a machine at work on the Quai Valouy, at Paris, which furnishes a considerable quantity of steam without any other source than that of friction. The machine consists of a cylindrical heater 2 metres long, 50 centimetres in diameter, having throughout its whole length, placed in its centre, a conical tube. The water, which is reduced to vapour, fills the void space between the inner walls of the tube or cylinder and the outer walls of the conical tube. Into the conical tube is passed a cone of wood, covered throughout with a braid of hemp rolled upon it spirally. The wooden cone is traversed by an iron axis, and fills exactly the interior capacity of the tube, so as to rub constantly against its walls. It is put in motion by a fall of water from the Canal St. Martin, so as to make about 400 revolutions per minute. The heat produced by the friction is sufficient to convert the water contained in the cylinder into steam. A thermometer placed within the boiler indicates, at the end of a certain time, a temperature of 130° C. The boiler is strengthened in the ordinary way, and is furnished with safety-valc, stop-cocks, a float, manometer, &c. The vapour reaches a pressure of nearly two and a half atmospheres. A lubricating apparatus constantly conveys to the envelope of the wooden cone the oil required to permit of its surface moving upon that of the interior of the conical tube. This machine holds 400 litres of water. To set it in action requires the power of two horses, it then produces sufficient steam to drive a one-horse engine. The inventors, MM. Beaumont and Major, hope thus to be able to utilise the force of falling water, and convert it into heat. This machine was at work at the Crystal Palace of Paris.

Silvered Porcelain Reflectors.

A new kind of reflector for lights was brought before the notice of the members of the Institution of Civil Engineers, on the 20th ult. It was composed of silvered porcelain, and appeared to possess a very brilliant polish, which was stated to be indestructible. Hitherto reflectors of small sizes only had been produced, but by means now adopted it was expected that they could be made as large as 21 inches in diameter over the mouth. If this manufacture was brought to the perfection that was anticipated, a great economy would result, as the silvered copper reflectors at present used were very expensive originally, were liable to oxidation, and were frequently injured by the care of the attendants in rubbing them to keep the reflecting surfaces bright. The new Porcelain Reflector had been transmitted by the Hon. Major Fitzmaurice to Captain Washington, R.N., by whom it was introduced to the notice of the meeting.

The Canadian Journal.—Close of the Series.

The present number brings the first Series of the *Canadian Journal* to a close. When, in August, 1852, the Council of the Institute ventured to risk the publication of an expensive monthly periodical, the Society did not embrace more than one hundred and fifty members. The *Journal* was "designed to afford a Canadian medium of communication between all engaged or interested in Scientific or Industrial pursuits, to assist and elevate the labours of the Mechanic, to afford information to the Manufacturer, and to administer to the wants of that rapidly-increasing class in British America, who are desirous of becoming acquainted with the most recent inventions and improvements in the Arts, and those Scientific changes and discoveries which are in progress throughout the world."*

The rapid increase in the number of the Members of the Institute, and the consequent speedy exhaustion of the present edition of the *Journal*, already increased from 500 copies monthly in 1852 and 1853, to 750 copies monthly in 1854 and 1855, has forced upon the Council the necessity of either reprinting the earlier Volumes, or issuing an enlarged edition of a New Series. The latter course has, for various reasons, been adopted, and with it such changes in the form, issue, and general objects of the *Journal*, as have seemed to the Council most in accordance with the present position and encouraging prospects of the Institute. The plan of the New Series will be found in the Annual Report for 1855, page 399 of this Volume.

The subjoined statement of the expenses incident to the publication of the *Journal* during the past year, and the receipts accruing from the sale of the monthly issues during the same period, will not be found uninteresting to those who gave timely and generous assistance and encouragement during the critical period of the first few months of its existence.

Total Expense of the Publication of the Canadian Journal for 1855		£380 0 3
Distributed to members, 508 copies monthly, estimated at 12s. 6d. per annum	£317 10 0	
Subscribers to Journal, not members of the Institute, 46 copies at 15s	34 10 0	
Distributed to Canadian Literary Societies on account of Government, 60 copies at 15s.	45 0 0	
Donations and Exchanges, foreign and Canadian, 43 copies, estimated at 10s.	21 10 0	
		418 10 0
Balance in favor of the Journal, for 1855		£37 9 9

Items in the Paris Exhibition.

Bust Reducing Lathe.—A lathe for copying and reducing irregular surfaces, which is extensively used in the United States for turning gunstocks, boot lasts, &c. The lathe exhibited is shown as executing a reduced bust of the Empress in marble, in which it seems to perform perfectly. A modification of the same machine is shown, reducing medallions in a similar manner.

Saw-mill Machinery.—The cut of an ordinary saw-mill being exactly vertical, and the teeth following one another in one line, a considerable power would appear to be expended in pulverising the sawdust already cut. In this machine this waste of power is obviated by a motion similar to that given by a man's arm in a saw-pit, and the saw is retired from the wood in the up-stroke. There is said to be a large saving of power by this alteration.

Doors, Windows, Blinds, &c.—These are remarkable specimens for quality and cheapness. The doors are pannelled and with moulded jambs. The windows are not hung with lines, but open and shut with a catch, and the degree of light may be regulated in the blinds. The makers will execute orders at Montreal at the following prices:—Door and framing complete for 19 francs. The window, 9 francs; the blinds, at 9 francs each. They are made by machinery.

Heat Producer.—An apparatus for producing heat by friction. A wooden cone wound round with hemp revolves inside a polished brass cone in the centre of a boiler; a slight pressure on the end of the wooden cone ensures its being kept tight inside the brass one, and the hemp being kept profusely lubricated prevents its becoming charred. With 20 square feet of rubbing surface, and a speed of 600 revolutions of the cone per minute, it is said to be capable of evaporating 66 lb. of water in an hour. This apparatus solves the converse of the problem accomplished by the steam-engine, that is, the power being given it produces heat.

Yield of the Copper Mines for 1855.

The total yield of the various mines for the present year was as follows:—

Ontonagon District.

	Tons.		Tons
Minnesota	1035	Adventure	80
Norwich	200	Ohio T. Rock	15
Rockland	170	Aztec	10
National	30	Ohio	5
Forest	100	Merchants'	3
Nebraska	20	Ridge	37
Windsor	38	D. Houton	30
Toltec	85		
Total from the Ontonagon District			2,176

Portage Lake District.

	Tons.		Tons
Isle Royale	245	Quincy	10
Portage	48	Pewabic	17½
Huron	10		
Albion	15		
Total from Portage Lake District			445½

Keweenaw Point District.

	Tons.		Tons.
Cliff Mine	1600	Summit	4
N. American	250	Star	5
Copper Falls	90	Central	48
N. Western	90	Eagle river	3
N. West	125	Fulton	2
Phœnix	5		
Native	2		
Total from Keweenaw Point District			2,234

Recapitulation.

	Tons.
Ontonagon District	2,176
Portage Lake do	325
Keweenaw do	2,234
Total	4,845

The value of copper on the wharves on Lake Superior is $440 per ton; total products $2,000,000. The gain in shipments this year over 1854 is 2,000 tons. The French Government have had a commission examining the Lake Superior mines, in consequence of their supplies b ing cut off from Russia, the result of which is that American copper was found to be far superior to the English and fully equal to the Russian. It is used in the manufacture of ordnance, and no inconsiderable quantities are consumed in the manufacture of jewelry, percussion caps, and a great variety of other articles. The superior tenacity of American copper is a very strong recommendation in its favour.

* See Prospectus.

Monthly Meteorological Register, at the Provincial Magnetical Observatory, Toronto, Canada West.—October, 1855.

Latitude, 43 deg. 39.4 min. North. Longitude, 79 deg. 21. min. West. Elevation above Lake Ontario, 108 feet.

Day.	Barom. at temp. of 32 deg. 6 A.M.	2 P.M.	10 P.M.	Mean.	Temp. of the Air. 6 A.M.	2 P.M.	10 P.M.	M'N.	Mean Temp. + or — of the Average	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	M'N	Humid'y of Air. 6 A.M	2 P.M	10 P.M	M'N	Wind. 6 A.M.	2 P.M.	10 P.M.	Mean Direct.	Mean Vel'y	Rain in Inch.	Snow in Inch.
1	29·460	29·418	29·372	29·412	52·4	63·2	55·1	56·9	+ 6·5	0.358	0·454	0.398	0·401	·93	·81	·93	·88	N b W	S b W	N E	W 37 N	4·55	0·285	...
2	·311	·293	·306	·300	54·9	60·4	51·0	55·2	+ 5·3	·392	·409	·334	·380	93	80	91	89	W b N	S S W	N W	W 24 N	4·12	0·020	...
3	·248	·236	·341	·279	52·8	59·8	50·3	53·1	+ 3·6	·323	·336	·284	·305	82	67	80	77	NWbN	N W	W b N	N 43 W	10·32	...	...
4	·360	·336	·375	·356	40·2	62·6	55·7	53·7	+ 4·7	·208	·399	·368	·335	84	72	85	82	Calm	S S E	W S W	...	...	Inap.	...
5	·382	·370	·317	·355	58·1	64·3	58·9	59·8	+11·2	·438	·482	·430	·447	92	82	88	89	S S E	S W	Calm.	...	...	0·430	...
6	·240	·234	·441	·310	50·7	47·8	42·4	46·9	— 1·3	·336	·256	·216	·261	92	78	81	81	N	W N W	W	...	...	0·160	...
7	·521	·543	—	—	37·5	47·7	—	—	—	·207	·260	—	—	93	80	—	—	S W	W		...	...	Inap.	...
8	·524	·529	·587	·552	41·2	46·9	37·7	42·1	— 5·4	·205	·271	·206	·227	80	85	91	85	W S W	S S W	W	...	...	0·030	...
9	·588	·514	·720	·618	40·3	59·5	50·5	50·3	+ 3·2	·223	·381	·302	·304	90	76	84	83	W N W	S S W	W N W	W 31 S	7·45	...	...
10	·857	·870	·707	·800	44·2	50·8	51·7	48·7	+ 2·1	·246	·290	·341	·289	86	80	90	85	NEbN	E b N	E b S	E 19 N	7·55	0·015	...
11	·423	·555	·639	·541	52·6	54·9	40·6	48·7	+ 2·5	·364	·170	·187	·246	94	40	74	72	E b S	W b S	W b S	W 1 S	13·97	Inap.	...
12	·698	·702	·704	·700	30·9	41·8	35·1	36·2	— 9·7	·143	·127	·159	·146	82	49	78	70	W N W	NWbW	W b N	W 18 N	10·67	Inap.	0.1
13	.611	·494	·424	·502	34·8	34·5	38·6	36·6	— 8·9	·140	·181	·210	·183	69	92	91	84	W	W N W	W N W	W 18 N	14·47	0·270	Inap.
14	·426	·490	—	—	40·2	46·5	—	—	—	·227	·227	—	—	92	73	—	—	W N W	NEbN	N b W	N 10 W	5·22	0·015	...
15	·514	·469	·667	·560	41·4	52·4	44·0	46·1	+ 1·3	·237	·337	·191	·263	92	87	68	84	Calm.	E b S	W	W	7·74	...	Inap.
16	·823	·855	·912	·868	33·7	44·2	29·9	36·3	— 8·2	·170	·170	·142	·159	89	59	85	76	W N W	W b N	W b N	W 21 N	8·27	...	...
17	·881	·762	·696	·776	29·0	47·1	44·9	40·9	— 3·3	·140	·213	·248	·203	87	67	83	79	W b N	SEbS	S	S 15 E	6·32	0·020	...
18	·617	·516	·588	·579	45·8	58·2	45·4	49·9	+ 5·9	·261	·350	·270	·289	86	73	90	82	S b E	SEbS	E b S	S 26 E	5·47	...	...
19	·579	·532	·595	·570	37·5	62·9	50·3	52·0	+ 8·2	·192	·385	·313	·310	86	69	87	80	S b E	S S E	W b S	S 13 E	7·95	...	...
20	·623	·633	·678	·645	45·0	60·5	54·2	53·6	+10·0	·265	·297	·358	·304	90	58	86	76	W b N	NWbW	N W	W 43 N	9·91	...	...
21	·585	·299	—	—	50·8	51·8	—	—	—	·282	·230	—	—	77	60	—	—	N E	NEbN	S S W	E 20 S	13·93	0·510	...
22	·487	·593	·681	·596	39·3	45·6	37·9	40·4	— 2·6	·212	·174	·174	·178	89	57	77	72	S S W	S W	W	W 31 S	9·45	...	..
23	·632	·612	·682	·647	35·9	36·6	33·7	34·8	— 7·9	·172	·169	·165	·166	82	79	86	82	W b N	NWbW	W b N	W 32 N	6·49	...	0·7
24	·699	·629	·561	·629	28·0	33·0	31·9	31·0	—11·5	·131	·129	·143	·135	84	69	79	77	N W	N N W	NWbN	N 36 W	14·09	...	...
25	·514	·538	·646	·571	31·6	37·2	35·3	34·8	— 7·4	·150	·141	·181	·150	84	64	88	75	N W	W N W	SWbW	W 12 N	12·57	...	Inap
26	·628	·380	·293	·432	35·2	43.2	44·5	41·4	— 0·6	·149	·167	·201	·171	72	60	69	66	SWbS	S b W	W b S	S 29 W	16·99	0·015	...
27	·332	·378	·111	·250	40·9	48·5	42·9	43·9	+ 2·1	·178	·203	·233	·214	70	60	85	75	SWbW	W	E S E	W 16 S	15·16	0·250	...
28	·180	·566	—	—	39·5	47·9	—	—	—	·228	·188	—	—	95	57	—	—	N N W	W N W	W b N	W 42 N	15·67	Inap.	...
29	·781	·588	·427	·580	32·3	50·4	47·4	44·0	+ 2·8	·156	·230	·290	·222	86	63	90	77	W N W	S	S b W	S 32 W	8·68	0·045	...
30	·538	·685	·893	·731	44·9	52·7	37·5	43·8	+ 2·8	·208	·136	·131	·148	70	34	58	54	W N W	W b N	N b E	W 24 N	11·86	...	...
31	·923	·719	·607	·730	31·6	46·7	50·3	44·2	+ 3·5	·152	·219	·304	·236	86	70	85	81	N E	E	S b W	E 30 S	7·92	0·420	...
M	29·566	29·535	29·555	29·551	40·9	50·6	44·4	45·4	+ 0·3	0·228	0·262	0.251	0 247	·85	·69	·83	·76	8·11	14·15	7·79	W 8 N	9·88	2·485	0·8

Highest Barometer...... 29·923, at 6 a.m. on 31st } Monthly range:
Lowest Barometer....... 28·945, at midnt. on 27th } 0·978 inches.

Highest registered temperature 68°·0, at p.m., on 5th } Monthly range:
Lowest registered temperature 22°·6, at a.m. on 12th } 45°·4.

Mean Maximum Thermometer.............. 52°·60 } Mean daily range:
Mean Minimum Thermometer....... ...... 34°·55 } 18.05.

Greatest daily range.........33°·2, from p.m. of 11th, to a.m. of 12th.
Least daily range .... 9°·4, from p.m. of 24th, to a.m. of 25th.

Warmest day....... 5th. Mean temperature......59°·83 } Difference,
Coldest day......... 24th. Mean temperature......30°·98 } 28°·85.

Greatest intensity of Solar Radiation, 80°·4 on p.m. of 1st } Range,
Lowest point of Terrestrial Radiation, 20°·0 on a.m. of 17th } 60°·4.

Aurora observed on 4 nights: viz. on 3rd, 4th, 11th and 16th.
Possible to see Aurora on 17 nights. Impossible on 14 nights.
Raining on 14 days. Raining 47·3 hours; depth, 2·485 inches.
Snowing on 5 days. Snowing 9·8 hours; depth, 0·8 inches.
Mean of Cloudiness, 0·68.
Thunder storms occurred on 11th at 8 a.m. (slight), and on 29th from 6 to 9 p.m., which was very severe, accompanied with lightning, hail and rain.
Halo's observed round the Moon on 19th at 10 p.m., diameter 43°, and on the 22nd at 10 p.m., diameter 44°.
Rainbow noted on 5th at 6.45 a.m.

Sum of the Atmospheric Current, in miles, resolved into the four Cardinal directions.

North.	West.	South.	East.
1958·95	3690·27	1524·07	661·89

Mean direction of Wind, W 8° N. Mean velocity 9·88 miles per hour.
Maximum velocity, 32·3 miles per hour, from 5 to 6 a.m. on 28th.
Most windy day, the 26th; mean velocity, 16·99 miles per hour.
Least windy day, the 2nd; mean velocity, 4·12 " "
Most windy hour, 1 p.m.; Mean velocity, 14·27 miles per hour.
Least windy hour, 5 a.m.; Mean velocity, 7·39 " "

Mean diurnal variation, 6·88 miles.
First Snow observed this season at 8 a.m. on the 13th.
Indian Summer from 16th to 26th (not well marked).

The Components and Velocity of the Wind are imperfect from the 4th to 8th inclusive—the Anemometer having been out of order.

The mean temperature of this month, and the quantities of Rain and Snow differ but little from the average; but the mean velocity of the Wind has surpassed the average of the last 8 years by 4·54 miles per hour, being greater than any other month during that period, with the exception of March 1855.

Comparative Table for October.

YEAR.	Temperature. Mean.	Dif. from Av'ge	Max. obs'vd	Min. obs'vd	Range	Rain. D's.	Inch.	Snow. D's.	Inch's.	Wind. M'n Direc.	Mean Velocity in Miles.	
1840	44·4	—0·8	68·5	23·9	44·6	13	1·860	3	...	...	...	
1841	41·6	—3·6	58·3	20·3	38·0	6	1·360	2	...	...	0·41	lbs.
1842	45·1	—0·1	68·5	30·0	38·5	8	5·175	0	..	...	0·35	lbs.
1843	41·8	—3·4	65·7	24·5	41·2	12	3·790	4	2·5	...	0·54	lbs.
1844	43·3	—1·9	69·6	17·8	51·8	7	impt.	4	12·0	...	0·43	lbs.
1845	46·4	+1·2	62·7	20·0	42·7	11	1·760	1	Inap.	...	0·26	lbs.
1846	44·6	—0·6	69·7	20·7	49·0	14	4·180	2	Inap.	...	0·44	lbs.
1847	44·0	—1·2	65·0	20·3	44·7	13	4·390	2	Inap.	...	0·19	lbs.
1848	46·3	+1·1	62·2	26·4	35·8	11	1·550	0	0·0	W 36 N	4·60	Mils.
1849	45·3	+0·1	59·2	25·5	33·7	13	5·965	1	Inap.	N 12 W	4·76	Mils.
1850	45·4	+0·2	66·6	24·8	41·8	10	2·085	0	0·0	W 24 N	5·30	Mils.
1851	47·4	+2·2	66·1	25·0	41·1	10	1·680	2	0·3	W 18 S	4·39	Mils.
1852	48·0	+2·8	70·7	29·8	40·9	12	5·280	0	0·0	N 5 E	4·47	Mils.
1853	44·4	—0·8	64·7	25·5	39·2	10	0·875	2	Inap.	W 2 S	4·72	Mils.
1854	49·5	+4·3	74·2	29·8	44·4	15	1·495	3	Inap.	N 25 E	4·60	Mils.
1855	45·4	+0·2	64·3	28·0	36·3	14	2·485	5	0·8	W 8 N	9·88	Mils.
											0·37	
M'n.	45·18		66·00	24·52	41·48	11·2	2·929	1·9	1·2		5·34	lbs.

Monthly Meteorological Register, St. Martin, Isle Jesus, Canada East.——October 1855.

NINE MILES WEST OF MONTREAL.

BY CHARLES SMALLWOOD, M.D.

Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 Feet.

Day.	Barom. eorreeted and redueed to 32° Fahr.			Temp. of the Air.			Tension of Vapor.			Humidity of Air.			Direetion of Wind.			Veloeity in Miles per Hour.			Rain in Inches	Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0.		
	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10. P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.	6 A.M.	2 P.M.	10 P.M.		6 A.M.	2 P.M.	10 P.M.
1	29·664	29·597	29·599	57·0	60·4	59·8	·468	·494	·512	·98	·94	·99	S b E	S b E	S b E	8·37	6·93	3·86	1·811	Rain.	Rain.	Cum. Str. 10.
2	·458	·489	·422	57·5	66·0	62·0	481	589	549	1·00	90	98	S b E	S W b W	S b E	7·50	5·50	0·31	2·593	Do.	Cirr. Str. 10.	Rain.
3	·272	·231	·296	57·1	66·1	60·0	473	574	502	1·00	89	96	E N E	N E b E	S E b E	11·13	6·24	7·24	0·243	Cirr. Str. 10.	Do. 6.	Cir. Str. 6. Auro.
4	·451	·380	·416	56·8	61·0	58·7	456	520	487	99	95	99	W	W b S	W N W	6·30	5·13	5·12	0·032	Do. 6.	Do. 6.	Str. 9. [Bor.
5	·480	·538	·559	56·2	68·1	63·0	432	582	470	94	85	80	S W b W	S b W	S b E	9·51	5·68	0·63	...	Str. 4.	Do. 5.	Clear.
6	·492	·292	·192	57·7	69·4	60·2	447	634	467	94	90	89	S	S	S S W	1·11	2·31	17·30	...	Do. 10.	Do. 4.	Rain.
7	·521	·615	·634	40·2	50·7	42·0	245	266	234	92	71	80	W S W	S W b W	S W b W	22·30	9·60	4·57	0·364	Cirr. Str. 8.	Do. 4.	Clear.
8	·719	·688	·776	38·6	55·2	42·2	226	331	263	91	74	92	S W	S W	S b W	8·93	3·90	2·48	...	Clear.	Do. 4.	Str. 2.
9	·779	·735	·797	34·0	59·4	46·1	204	452	313	95	89	95	S b W	S S W	N N W	0·73	3·63	2·70	0·200	Str. 2.	Rain.	Rain.
10	·992	30·002	30·034	42·6	60·0	41·1	263	393	241	92	75	89	W N W	S W b W	S b E	2·93	2·23	1·40	...	Clear.	Cirr. Str. 4.	Clear. Aurora B.
11	·803	29·544	29·715	38·0	61·3	44·0	227	389	207	92	73	80	E b N	S S E	W S W	1·35	11·83	17·40	0·300	Do.	Cir. Cum. Str. 4.	Rain.
12	·704	·756	.753	40·9	42·9	41·1	274	263	264	99	92	98	W S W	N W b W	W N W	6·30	4·07	7·32	1·643	Rain.	Rain.	Do.
13	·589	·489	·526	50·8	57·7	53.0	386	422	397	99	89	99	N E b E	E N E	S S E	6·09	21·14	16·10	0·600	Rain.	Cir. Str. 10.	Do.
14	·789	·741	·729	40·1	52·3	38.6	260	274	226	99	69	91	S S E	S S E	N E b N	5·26	1·47	7·07	0·121	Clear.	Cir. Cum. Str. 6.	Str. 10.
15	·714	·748	·689	33·6	50·1	42·3	214	264	269	99	70	98	W b N	W b S	S	3·72	6·02	1·60	Inapp.	Do.	Cirr. Str. 10.	Do. 10.
16	·749	·891	·940	36·1	51·4	38·7	210	274	207	91	70	84	W N W	W N W	W N W	5·92	15·00	8·42	...	Cirr. Str. 8.	Do. 4.	Do. 8. Aurora B
17	·992	·883	·847	31·0	47·7	36.3	164	214	210	85	69	91	W b N	W S W	S S W	4·93	5·41	5·50	...	Clear.	Light Cirr. 3.	Cir. Str. 10.
18	·737	·742	·795	41·0	48·2	46·8	263	281	303	94	80	93	W S W	W S W	S b E	7·65	1·62	0·21	0·110	Str. 10.	Cir. Str. 4.	Do. 10.
19	·810	·657	·730	40·0	65·9	47·8	254	450	349	99	69	98	E b N	W b E	S b W	0·21	0·22	0·87	...	Fog.	Clear.	Clear.
20	·755	·732	·836	46·0	65·9	51·1	313	440	315	96	68	81	S S W	S W b W	N W	1·26	2·06	0·58	...	Hazy.	Do.	Do.
21	·804	·664	·550	47·1	56·1	44·0	262	323	261	79	70	85	N E	N E b N	N E b E	8·21	16·06	16·46	...	Clear.	Clear.	Cum. Str. 10.
22	·674	·752	·720	46·0	50·1	41·5	271	264	201	84	70	73	W S W	W b S	N W b W	15·42	16·62	17·32	Inapp.	Str. 2. [4.	Cir. Str. 10.	Do. 8.
23	·784	·757	·777	34·5	42·1	37·0	178	225	201	84	79	90	N W b N	S W b S	S S W	6·25	3·03	1·50	Inapp.	Cir. Cum. Str.	Do. 10.	Do. 10.
24	·879	·698	·588	30·6	33·2	32·0	161	197	199	89	94	96	N W b W	N E b N	N E b N	0·11	4·30	17·82	...	Cir. Str. 6.	Sleet.	Snow.
25	·350	·512	·606	32·6	39·4	32·2	196	214	197	99	84	97	N W	W S W	W S W	6·16	9·12	14·92	0·900	Sleet.	Cir. Str. 8.	Cir. Str. 10
26	·783	·740	·680	30·6	40·9	36·0	178	207	215	92	76	94	W S W	N W b W	S S E	18·12	4·90	4·93	...	Cirr. Str. 6.	Do. 6.	Do. 10.
27	·493	·416	·397	36·2	45·2	40·0	231	272	237	99	86	86	S b E	S W	S W	10·15	2·21	10·85	0·096	Rain.	Do. 4.	Str. 10.
28	·290	·451	·534	32·1	40·0	35·0	182	194	213	91	73	94	N	N W	W N W	8·11	11·82	9·35	...	Cir. Cum. Str.	Do. 10.	Cir. Str. 4.
29	·846	·870	·697	32·2	43·1	38·1	191	216	217	92	73	87	W N W	W S W	S b E	22·51	9·75	4·33	...	Str. 2. [3.	Cir. Cum. Str. 8.	Cir. Cum. Str. 4.
30	·449	.565	·934	39·1	52·0	35·6	246	201	186	93	51	83	S W b W	W	W N W	4·67	22·40	16·18	0.003	Shower, 5.30	Cirr. Str. 2.	Clear.
31	30·150	30·101	·896	28 0	49.1	37·0	153	251	201	88	69	86	N W W	S S E	S E b E	0·83	1·92	0·93		Clear. [a. m.	Clear.	Meteor 8.40 p.m.

Barometer ....
- Highest, the 31st day .... 30·150
- Lowest, the 6th day .... 29·192
- Monthly Mean .... 29·695
- " Range .... 0·958

Thermometer
- Highest, the 5th day .... 73°·2
- Lowest, the 31st day .... 27°·6
- Monthly Mean .... 46°·35
- " Range .... 45°·6
- Mean Humidity .... ·849

Greatest Intensity of the Sun's Rays .... 107°·6
Lowest Point of Terrestrial Radiation .... 21°·1
Amount of Evaporation, 1·40 inehes.

Rain fell on 17 days, amounting to 8·728 inehes, Raining 98 hours. 35 minutes.
Snow fell on 1 day, amounting to 2·10 inehes, snowing 14 hours 0 minutes.
Most prevalent Wind, W.S.W. Least prevalent Wind, E.
Most Windy Day, the 22nd; mean miles per hour, 16·45.
Least Windy Day, the 19th; mean miles per hour, 0.43. First Snow fell on the 24th day.
Aurora Borealis visible on 3 nights. Might have been seen on 6 nights.
Lunar Halo on the 24th day, at 2.30 a. m. Diam 31°4.
Eelipse of the Moon, invisible, owing to cloudy weather.
Sum of the Atmospheric Currents in Miles resolved into the Cardinal Points, N. 794.60; S. 995.20; E. 741.45; W. 1950·37; Total 4481·62 miles.
The electrieal state of the atmosphere has been marked by very feeble intensity.
Ozone was in rather large quantity, amounting on several days to eomplete saturation.
This is the most windy Oetober on rceord here. Maximum Veloeity 32.14 miles per hour.

Monthly Meteorological Register, Quebec, Canada East, October, 1855.

BY LIEUT. A. NOBLE, R. A., F.R.A.S., AND MR. WM. D. C. CAMPBELL.

Latitude. 46 deg. 49·2 min. North; Longitude, 71 deg. 16 min. West. Elevation above the level of the Sea, about 200 Feet.

Date.	Barometer corrected and reduced to 32 degrees, Fahr. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Temperature of Air. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Tension of Vapour. 6 A.M.	2 P.M.	10 P.M.	MEAN.	Humid'y of Air. 6 A.M.	2 P.M.	10 P.M.	M'N	Direction of Wind. 6 A.M.	2 P.M.	10 P.M.	Velocity of Wind. 6 A.M.	2 P.M.	10 P.M.	Rain in Inch.	Snow in Inch.	REMARKS.
					°	°	°	°																	
1	29·698	29·698	29·664	29·687	55·3	56·7	53·3	55·1	0 409	0·403	0·372	0·395	95	90	93	93	E N E	E N E	E	13·4	13·4	15·2	1·082	...	
2	·575	·510	·514	·533	55·0	56·8	55·6	55·8	·423	·394	·415	·411	100	87	96	94	E N E	E N E	E N E	16·0	21·3	22·7	3·762	...	
3	·386	·349	·384	·373	54·4	57·1	56·8	56·1	·404	·413	·430	·416	97	91	96	95	E N E	E N E	E	19·7	16·0	11·3	·092	...	
4	·436	·390	·335	·387	55·4	58·9	54·1	56·1	·421	·438	·403	·421	98	90	98	95	E N E	E N E	E N E	11·3	15·4	15·2	·217	...	
5	·430	·513	·552	·498	52·6	58·8	56·8	56·1	·378	·406	·421	·402	97	83	93	91	E N E	Calm.	Calm.	12·4	0·0	0·0	·013	...	
6	·508	·340	·129	·326	53·3	55·1	56·2	54·9	·395	·419	·430	·415	99	99	97	98	Calm.	E N E	E N E	0·0	10·0	8·0	·330	...	
7	·382	·499	·604	·495	42·3	50·1	41·8	44·7	·215	·171	·204	·197	81	48	78	69	W N N	W S W	W S W	16·0	12·4	6·2	...	...	
8	·677	·650	·717	·681	40·9	48·4	41·8	43·7	·196	·245	·207	·216	77	74	80	77	S S W	W N W	Calm.	3·8	3·3	0·0	...	...	
9	·742	·715	·754	·737	39·3	50·6	44·1	44·7	·209	·225	·261	·232	88	62	91	80	S	S S W	N b W	6·2	5·2	10·4	·138	...	
10	·843	·934	·972	.916	41·0	51·5	41·1	44·5	·239	·264	·232	·245	93	71	91	85	W N W	W	W	8·8	10·0	3·8	...	...	10th. Min. ter. rad. 30°·3.
11	·909	·700	·687	·765	38·2	53·1	51·9	47·7	·218	·257	·211	·229	95	64	55	71	E	E N E	E N E	2·0	21·3	11·3	...	...	
12	·711	·712	·724	·716	51·1	56·5	52·0	53·2	·315	·280	·315	·303	85	63	82	77	E N E	E N E	E N E	12·4	12·4	22·7	·409	...	
13	·672	·631	·652	·652	51·8	54·0	53·0	52·9	365	·385	·366	·372	97	94	93	95	E N E	E N E	E S E	27·8	22·7	21·3	1·584	...	
14	·747	·707	·662	·705	49·3	54·0	48·8	50·7	·315	·297	·316	·309	91	73	93	86	Calm.	N	E N E	0·0	3·8	2·0	...	...	
15	·575	·541	·607	·574	42·3	51·0	45·4	46·2	·247	·226	·237	·237	93	62	80	78	W N W	E	S W	5·2	5·2	10·0	...	...	
16	·641	·715	·806	·721	43·5	48·6	38·9	43·7	·242	·201	·169	·204	87	60	72	73	W S W	W S W	WN W	2·0	8·8	11·3	...	...	
17	·849	·773	·715	·779	33·6	40·8	38·1	37·5	·157	·161	·184	·167	81	64	80	75	N	W S W	S W	8·8	14·3	2·0	·040	...	
18	·644	·612	·713	·656	38·1	44·9	45·3	42·8	·210	·231	·260	·234	93	79	87	86	Calm.	S W	W S W	0·0	3·8	5·2	...	...	
19	·752	·696	·687	·712	45·2	51·4	46·6	47·7	·273	·275	·276	·275	91	74	88	84	Calm.	Calm.	Calm.	0·0	0·0	0·0	...	...	
20	·692	·713	·751	·719	48·0	58·9	51·9	52·9	·285	·347	·330	·321	87	71	86	81	W S W	Calm.	W S W	5·2	0·0	2·0	...	...	
21	·842	·729	·544	·705	47·4	45·8	41·8	45·0	·230	·175	·250	·218	72	57	97	75	E b N	E	E	32·2	25·4	42·5	·316	...	21st. At 8 p.m., gusts of wind 48 to 50 miles per hour.
22	·404	·361	·589	·451	43·5	48·5	43·9	45·3	·278	·221	·211	·237	100	66	74	80	E	W S W	W b S	7·3	3·8	10·0	...	...	
23	·645	·612	·708	·655	35·6	44·6	39·8	40·0	·164	·182	·182	·176	79	61	75	72	W	Calm.	S	10·0	0·0	3·8	...	...	
24	·817	·762	·477	·685	36·2	35·8	35·4	35·8	·183	·193	·199	·192	86	92	96	91	S	E N E	E N E	3·8	8·8	22·7	·858	Inap	24th. Mountains covered with snow.
25	·211	·189	·307	·236	39·0	37·0	34·2	36·7	·231	·199	·171	·200	91	91	86	89	E N E	S W	W	22·7	10·0	17·9	·119	0·1	
26	·610	·657	·603	·623	29·3	35·3	35·1	33·2	·134	·146	·167	·149	82	71	82	78	W S W	W S W	W S W	13·9	8·8	2·0	...	...	
27	·445	·337	·288	·357	37·4	41·9	39·0	39·4	·184	·207	·208	·200	83	79	88	83	S S W	Calm.	S S W	3·8	0·0	10·0	·040	...	
28	·186	·196	·405	·262	35·0	42·4	35·5	37·6	·187	·180	·146	·171	92	67	70	76	Calm.	N W	N N W	0·0	8·8	6·2	...	...	28th. 6 a.m., ter. rad. 31°1.
29	·633	·674	·553	·620	32·0	38·0	34·2	34·7	·128	·119	·160	·136	71	51	81	68	W	W S W	W S W	10·1	3·8	3·8	·138	...	
30	·343	416	·738	·499	36·7	43·1	36·8	38·9	·205	·170	·150	·175	95	62	69	75	W S W	W S W	W	3·8	5·2	12·4	...	...	30th. Min. ter. rad. 21°·0.
31	30·063	30·035	·953	30·017	30·7	39·3	34·5	34·8	·135	·119	·160	·138	79	50	79	69	W	W	E	5·2	3·8	2·0	·106		
M	29·6151	29·5925	29·6062	29·6046	43·01	48·64	44·63	45·43	0·257	0·256	0·259	0·258	89	72	85	82				9·15	8·97	8·84	9·244	0·1	

Maximum Barometer, 6 a.m. on the 31st........ 30·063
Minimum Barometer, 6 a.m. on the 28th........ 29·186
Monthly Range........ ·877
Monthly Mean........ 29·6046
Maximum Thermometer on the 5th........ 60°·4
Minimum Thermometer on the 25th........ 28·4
Monthly Range........ 32·0
Mean Maximum Thermometer........ 50·38
Mean Minimum Thermometer........ 40·00
Mean Daily Range........ 10·38
Mean Monthly Temperature........ 45°·43

Greatest Daily Range of Thermometer on 10th........ 18·2
Least Daily Range of Thermometer on 3rd........ 3°·3
Warmest Days, 3rd, 4th, 5th. Mean Temperature........ 56·1
Coldest Day, 26th. Mean Temperature........ 33·2
Climatic Difference........ 22·9
Possible to see Aurora on 7 Nights.
Aurora visible on 7 Nights.
Total quantity of Rain, 9·244 inches.
Total quantity of Snow 0·1 inches.
Rain fell on 16 days.
Snow fell on 2 days.

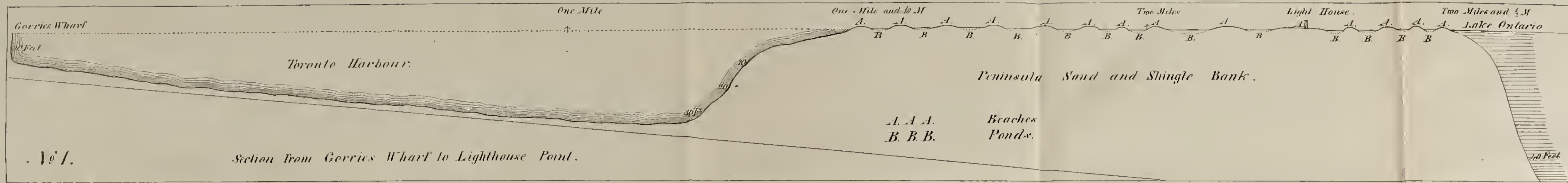
No. 6.

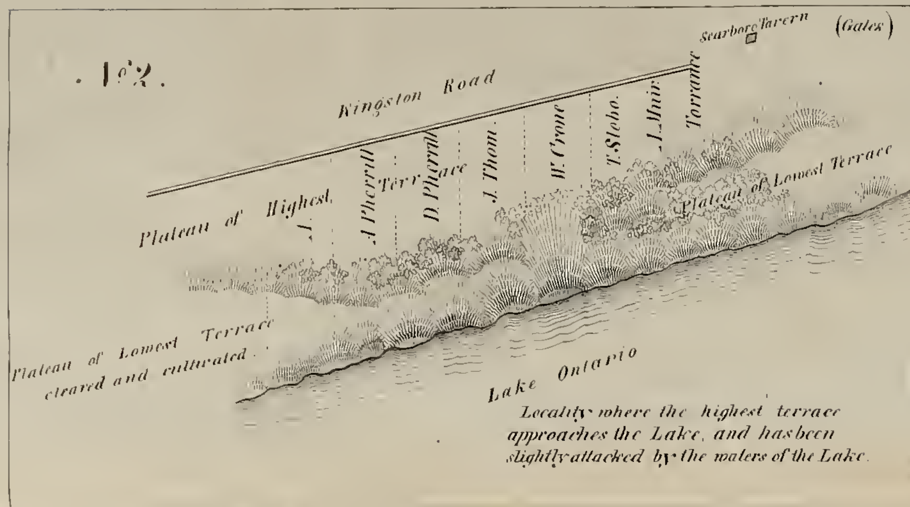
Diagram to illustrate the First Premium Report

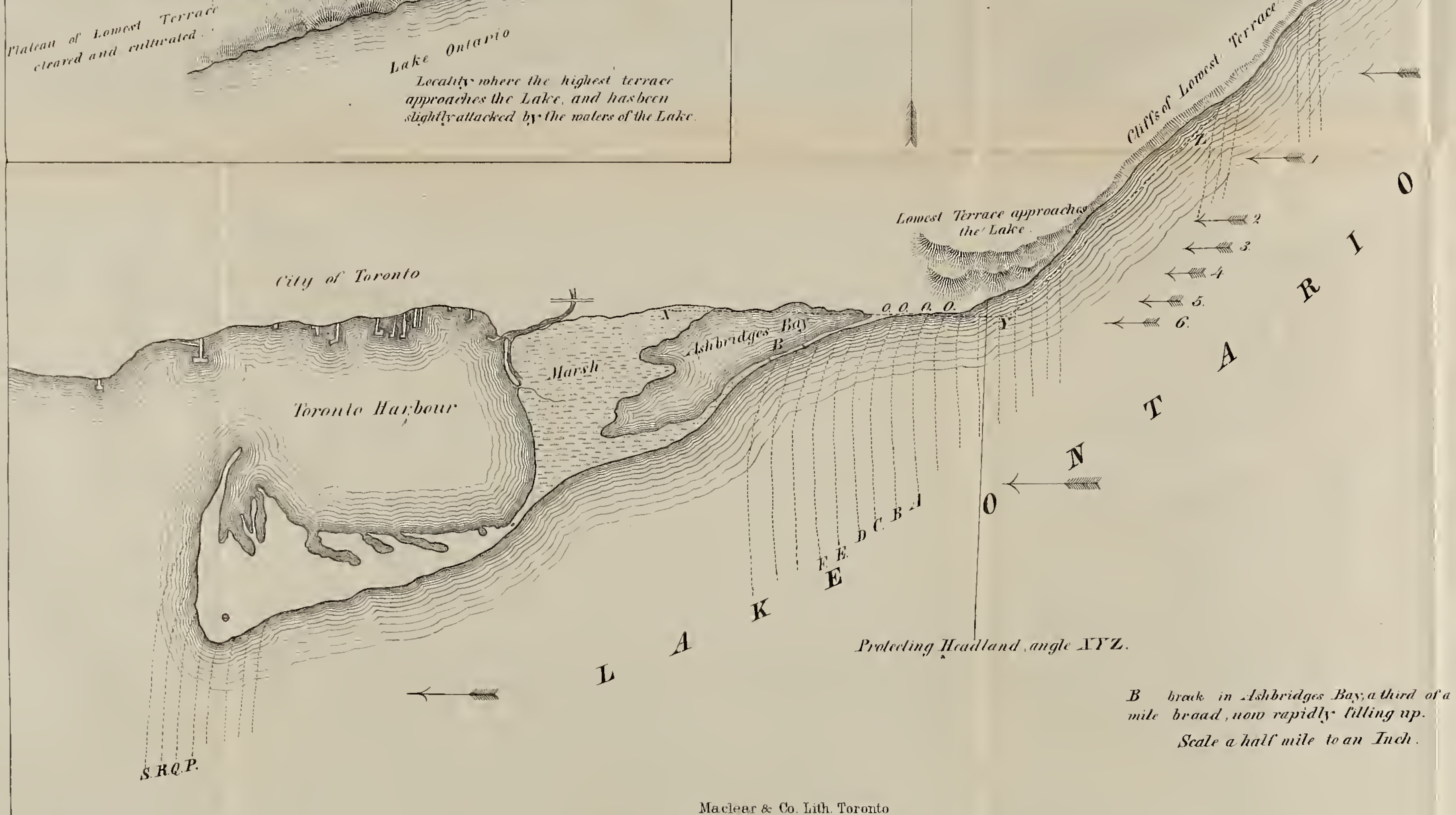
Diagram to illustrate the First Premium Report

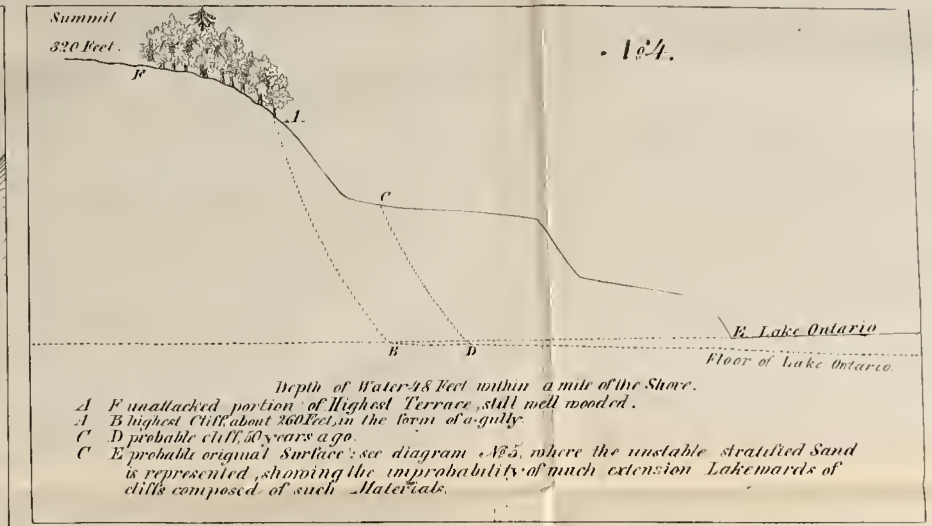
Maclear & Co Lith. Toronto

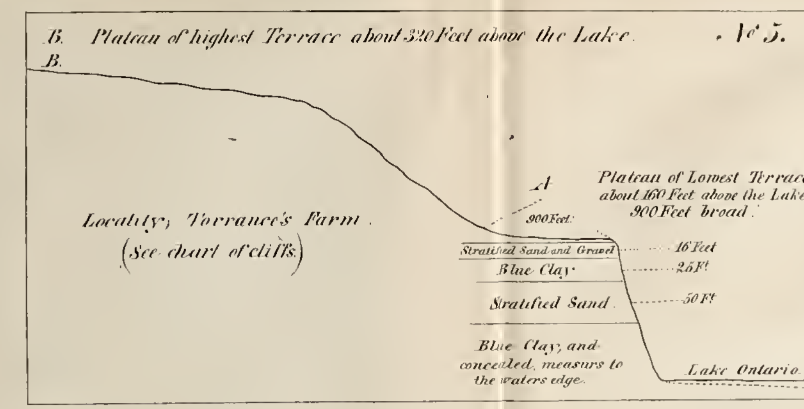
Diagrams to illustrate the First Premium Report.

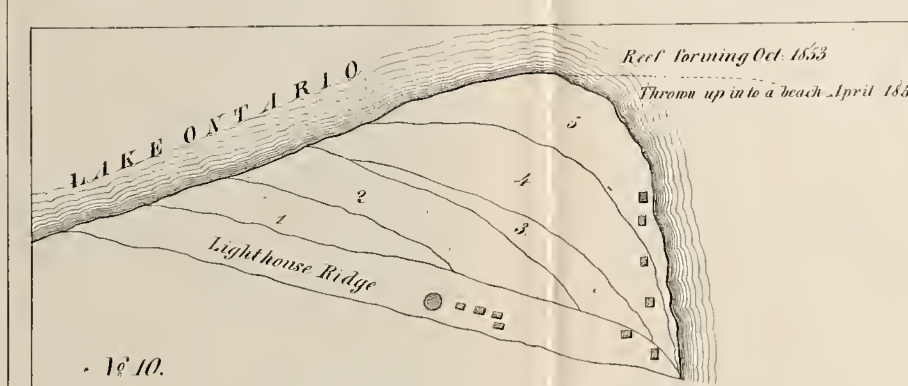












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REPORTS ON THE IMPROVEMENT AND PRESERVATION

OF

TORONTO HARBOUR.

PUBLISHED BY THE AUTHORITY OF THE HARBOUR COMMISSIONERS.*

HARBOUR OF TORONTO.

THE Commissioners of Toronto Harbour, having decided upon offering premiums for the best Reports on the improvement and preservation of the Harbour, and appropriated the sum of £112 10s. for that purpose, and the Common Council of the City of Toronto having also voted a similar sum for the same object:

NOTICE IS HEREBY GIVEN,

That three premiums of £100, £75, and £50, respectively, will be given for the three best Reports on the means to be adopted for the preservation and improvement of the Harbour of Toronto.

Such Reports to embrace the following subjects:

The effects which have been produced, or are likely to be produced, by the present breach at the Eastern extremity of the Bay of Toronto, particularly with reference to the Bar, at the entrance of the Bay. If prejudicial to the Harbour, suggest the best means of closing it, and of strengthening that part of the Peninsula against further encroachments by the waters of the Lake.

Furnish also a statement as to the probable cost of such works.

If, on the other hand, a permanent opening at that end of the Harbour should be shown to be a benefit rather than an injury, furnish full particulars as to the best mode of making a Canal, and the probable cost thereof.

Also, as to the advisability, or otherwise, of enlarging the opening between the Harbour and Asbridge's Bay, or of making a permanent opening into the Lake, from Asbridge's Bay, and the cost thereof.

The Reports must be sent in not later than the 15th of April next, addressed to the Chairman of the Commissioners of the Toronto Harbour.

Two copies of all such Reports to be furnished, one for the Harbour Commissioners Office, and the other for the Clerk's Office of the City of Toronto.

Harbour Commissioners' Office,
Toronto, March 14, 1854.

TORONTO HARBOUR.

THE period for receiving the proposed Reports "on the preservation and improvement of the Toronto Harbour," is extended to the 4th of May.

The Commissioners desire it to be understood, that it is not requisite that the Reports should embrace detailed estimates of the cost of the proposed works, except in so far as will suffice to give a general idea of the comparative expense of the different plans proposed.

Harbour Commissioners' Office,
Toronto, April 1, 1854.

REPORT

ON THE PRESERVATION AND IMPROVEMENT

OF

TORONTO HARBOUR,

BY HENRY YOULE HIND, M.A., PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF TRINITY COLLEGE.

[*The first premium of One Hundred Pounds was awarded to the author of this Report.*]

The questions proposed by the Commissioners of Toronto Harbour respecting the means to be adopted for its preservation and improvement, involve as a primary consideration the origin and distribution of the entire mass of accumulated materials from near the town line of Scarboro' and York to within a few hundred yards south of the Garrison Wharf, thus embracing the whole of the sand and shingle beach enclosing Ashbridge's Bay and the swamps of the Don, together with the Peninsula boundary of Toronto Harbour and its westerly subaqueous extension towards the Humber Bay. Various theories have been advanced from time to time with a view to unveil the history of the formation of the Harbour. The citizens of Toronto are familiar with the names of Roy, Bonnycastle, Fleming, Shanly, Tully, and Richardson, in connection with this important subject. The views of these gentlemen have been brought before the public in various ways, either in papers read before the Mechanics' Institute, (Roy,—published in the Monthly Review, June, 1841), the Canadian Institute (Fleming, 1850–51), or in the form of reports and letters, (Bonnycastle, Shanly, Tully, and Richardson). Allusions are also made to the encroachments of the Sand-bar towards the Queen's Wharf in the reports of the officers connected with the Board of Works, and published in the Sessional papers of the Legislative Assembly. Notwithstanding a discussion in which so many have taken a part. and which has been extended over a period of fifteen or twenty years, the subject does not appear to be exhausted and perhaps still offers room for additional speculations. It is essentially a geological subject, involving the present active operations of those forces which, on a scale of greater magnitude, have recorded their existence and power on the shores of every tidal and tideless expanse of water. Nor can the preservation of the Harbour, with

* The Commissioners of Toronto Harbour, in addition to the liberal premiums awarded for the following Reports, have placed in the hands of the Treasurer of the Canadian Instituto sufficient funds to cover the expenses of the r publication in the *Canadian Journal*

any propriety, be considered apart from the limits of geological science; the remedial measures proposed would then resemble guesses at a remedy for an unknown and dangerous disease.

The President of the Board of Works in 1844 reported to the Provincial Secretary that, "at the inlet of the Toronto Bay the sand is evidently making much, and I am of opinion, that at no remote period some work must be encountered to fix and preserve such an entrance as the rapidly increasing trade of that important City will require." In 1847 Mr. Gzowski reports (Sessional Papers, Legislative Council, 1847) to the Secretary of the Board of Works that, "from the data that could be obtained from several masters of vessels, who have certain permanent landmarks (now existing) to guide them in coming in and going out of the Harbour, it was ascertained that within the last seven years the bar had made a distance of 280 feet." Further on he observes, "there can be no doubt that the making of the bar is caused by the wash and drift of the sand and shingle from the *southern portion of the Peninsula*, which is carried when the wind is from the east, which, from want of a sufficient current in the Bay, when the wind changes to the west, is not carried out, but remains forming the bar referred to, and which, if not prevented by the construction of works, and increasing and confining the current will very soon destroy the entrance to the Harbour."

Of all the explanations which have been advanced in relation to the origin and progress of formation of the Peninsula boundary of Toronto Harbour and its subaqueous extension, the one which appears to be most complete and at the same time most consistent with observed phenomena, in many important particulars, is that submitted by Mr. Sandford Fleming, C. E. Mr. Fleming's views have been fully explained in two papers, read by him before the Canadian Institute, and since published in the Canadian Journal (Vol. II., p. 105 and 223). It appears necessary that the adoption wholly or part, of any particular theory of Toronto Harbour, out of several which have been offered to the public, should be accompanied by satisfactory reasons for the selection. In accepting the main features of Mr. Fleming's theory, the writer cannot give assent to that gentleman's exposition of the early history of Toronto Harbour, or of the Delta of the Don, or to the remedial measures for the preservation of the Harbour. It is but just to add, however, that many important features of Mr. Fleming's explanations, which will be referred to hereafter, are thought to *involve* the true history of the Peninsula as to its origin and developement, the question of time not being taken into consideration. The views submitted in a report to the Harbour Commissioner that the origin of the Peninsula is to be traced to detritus brought down by the rivers to the west of Toronto, is completely set aside, first by Lieut. Herbert's Chart of Lake Ontario, which gives a depth of ninety feet between the southern limits of the Humber Bay and the Lighthouse point; second, by Mr. Fleming's measurements, which show a depth of sixty feet about sixty chains from the Garrison Common beach; third, by the direction of the prevailing winds and their influence upon the expanse of water exposed to them; fourth, by the impossibility of masses of sand and shingle creeping along the shore in water sufficiently shallow for waves to impel them from the west, without leaving traces of their passage in the form of beaches and shoals; fifth, by the ponderous nature of the materials of which the Peninsula consists, namely, shingle, pebbles, coarse felspar and quartz sand, and black magnetic oxide of Iron;* and sixth, by the topographical conformation of the Peninsula, which shortly, will be described.

The geological conformation of this part of the country is altogether contrary to the supposition that the basis of the Peninsula in an upheaval of the Hudson River Group, upon which shingle and sand have been deposited. The Hudson River Group extends from beyond the Rouge to the Credit, and forms the basis of the drift which covers the country. Its character in this neighbourhood is any thing but persistent as shown by the uniform depths to which the Rivers Don, Humber, Mimico, &c., have succeeded in cutting it. In its exposures in all the localities mentioned, including also the Garrison Common cliffs, and the west side of the Humber Bay, it exhibits blue argillaceous shales alternating with bands of calcareous sandstone, and occasionally limestone bands. Its descent into the Bay and Lake is gradual, and within a distance of 500 yards north of Privat's Hotel it is not reached at a depth of 30 feet.† The water-worn shingle which largely enters into the composition of the Peninsula contains occasionally fossils belonging to this rock, but they do not differ from those which may easily be found in the drift clay superimposed upon it on the neighbouring shore, and which, during the deposition of the drift, have been washed out of some more northern exposure. (See the Geological Report for 1845, page 88). That shingle of the Hudson River Group forms the base or foundation of the Peninsula is quite possible, but it is more than probable that all the shingle found there has been transported to its resting-place and had its origin in the drift clay of the neighbouring shores of the Lake to the eastward.

Mr. Fleming separates the history of the delta of the Don from that of the Peninsula boundary of Toronto Bay, and he carries us back into the dim and misty ages of the Quarternary period in order to account for the deposition at the mouth of the Don of its present 'delta.' "Having thus," he says, "shewn that sufficient time may be granted, the Don therefore supplies an adequate cause for performing, and completing long since the work assigned to it; year after year during its early history, slowly but constantly hollowing out a channel and removing the former contents of its valley to the Lake, the lighter and more soluble matter being held for some time by the water, to be distributed far and wide, the heavier particles on the other hand, to be deposited near its mouth in the form of an extensive shoal or delta,—the base or ground work of the Peninsula, on which again to be deposited a drift from other causes and from another source."—(See page 107, Canadian Journal, Vol. II.)

His arguments for the antiquity of the marshes of the Don, to be hereafter alluded to, are so intimately connected with his views of the former probable extent and influence of the Scarboro' heights, that it is desirable, before proceeding further, to examine the existing phenomena of that range of hills and cliffs, and see how they agree with the descriptions which have been given of them.

The following description of the Scarboro' heights is the result of a personal visit to that romantic and picturesque range of cliffs during the present month. (April, 1854.) The Scarboro' heights consist of two distinct terraces, which run into one another on the farm of W. Crone,‡ about nine miles from Toronto. These ter-

* See Note A. in Appendix. † See Note B. in Appendix.

‡ See Map of the Township of Scarboro' for names, by J. Ellis, Toronto.

races attain their utmost elevation near Scarboro' tavern; (Gates') the elevations of the terraces, as measured by Mr. Murray, the assistant Provincial Geologist, are as follows:—

First Terrace above the Lake	161 feet
Second Terrace above the First	159 ,,
Second Terrace above the Lake	320 ,,

—*See Geological Report for* 1845.

As before remarked, these terraces run into one another on Mr. Crone's farm, that is to say, the second or highest terrace trends here so much to the South *that a portion* of it has fallen into the waters of the Lake, as shown in section No. 4. The slope of the second or highest terrace has been denuded by the fall of its materials to the extent of about 100 feet, so that the perpendicular altitude of this, the highest denuded portion of the Scarboro' heights, does not exceed 260 feet, upon the basis of Mr. Murray's altitudes, which, for the total height of the first and second cliffs are the same as those given by Mr. Fleming, namely, 320 feet. About 60 feet of the cliffs of the second terrace still remain clothed with heavy timber, and have not contributed any materials to increase the deposition on the shore of the peninsula boundary of Toronto Bay. It is highly probable that the present generation has witnessed the fall of the first contribution of the second or highest terrace to the sand shoals of the Lake, and it may confidently be asserted that 50 years ago the second terrace was separated from the first by a narrow plateau several yards in breadth, and consequently quite unaffected throughout its entire developement in the township of Scarboro' by the waters of the Lakes. On the next farm to the westward, that of J. Thom, the second or highest terrace has been still less subject to the effect of the encroachments of the Lake, and remaining portions of the first terrace can be seen forming projections in the sides of the crater like cavities produced by the land slips which have caused these extensive and destructive removals.

The next farm to the west belongs to D. Pherill, there the second terrace is attacked to a very trifling extent, and the projecting remains of the first terrace are more distinctly seen. On the junction between the farms of A. Pherill & A. Ashbridge (the next succeeding to the west,) the second terrace leaves the Lake, and retires into the interior, as shown in the diagram No. 2.

It thus appears that the amount of materials derived from the destruction of the second terrace is inconsiderable. and might be altogether embraced in a dozen gullies similar to that represented in fig. 3, which was sketched this spring, and of which there are great numbers equalling it in capacity, along the first or lowest terrace, between Gates' Farm and a mile or two to the east of the commencement of Ashbridge's Bay. Mr. Fleming's ingenious speculations with respect to the original form of the Scarboro' heights, and their relation to earlier developments of Toronto Harbour, as exhibited in his diagrams numbered 9, 10, 11, 12 and 16,* become imaginary, and the section number 16 assumes the probable form exhibited in diagram No. 4, in one spot only; the highest cliff contributing its materials to the Lake, not exceeding, 50 years ago, the height of 160 feet. Although Mr. Fleming's account of the past history of the Scarboro' heights, and, as will be shown hereafter, of the marshes, or Delta of the Don, is not borne out by existing topographical conditions, yet it happens that its failure in this respect does not interfere with his views of the formation of the Harbour in its *present* condition and development. The first or lowest terrace, from the nature of the materials entering into its composition, and its altitude, (in some places 160 feet) affords abundant supply of detritus to explain the formation of the sand and shingle beaches constituting the peninsula boundary of the Harbour and of Ashbridge's Bay.

The first terrace is composed of stratified sand and gravel, and of blue clay. In one of the gullies adjoining that represented in fig. 3, the following order of stratification was observed by the writer. The same order of stratification was frequently noticed along the cliffs of the first or lowest terrace:†—

Yellow clay and vegetable mould, about	2 feet.
Stratified sand and gravel	16 ,,
Blue clay, ...	25 ,,
Stratified sand	50 ,,
Blue clay and concealed measures to the water's edge.	

Diagram number 5 shows the stratification in a gulley near Gates' farm.

A layer of two feet of small water worn boulders from one inch to six inches in diameter is very persistent about 10 feet from the surface of the lowest terrace; coarse and fine sand, beautifully stratified, occur in vast quantities; in fact the cliffs now present every requisite feature for rapid destruction.

They did not present these features fifty years ago, and there can be no question but that the operations of the settler have exercised a vast influence upon the recent rate of progress with which the destruction of the cliffs has taken place, and (as a not very remote consequence) the alarming rapidity with which the peninsula boundary of Toronto Harbour has increased during late years. In 58 years upwards of 30 acres have been added to the peninsula in deep water beyond the Light-house, on Light-house Point. The shoal towards the mouth of the Bay has increased to a very threatening extent, and has spread in the direction of Humber Bay from Light-house Point; a new reef is rapidly forming which, perhaps, this season will effect a fresh addition of 10 or 12 acres to the western limit of the peninsula, as indicated on the Map No. 6, and which only requires a period of low water to develope itself in the form of a beach. Now, all these enormous changes in so short a space of time imply the existence of no ordinary forces or supply of materials, for they have occurred in deep water, and involve the removal of many million tons of shingle and sand.

It is now proposed to consider the relation of the Scarboro' cliffs to the existing peninsula boundary of Toronto Harbour, without entering into speculations, as yet, as to its early history. The problem is not difficult of solution, and it is thought to be one of the utmost importance, as it seems to lead at once to those remedial measures which the preservation of the Harbour demands. It points to a power which has been slowly and beneficially acting for centuries, but which has suddenly become energetic and dangerous in its recent extension.

A stroll along the precipitous cliffs of the lowest terrace, from Gates's farm to where the partial union of the two terraces takes

* See "Canadian Journal," Vol. II., page 223.

† Note C, Appendix.

place on Crone's farm, then onward towards Toronto, within a mile or two of the commencement of Ashbridge's Bay, will enable the observer to comprehend the remarkable effect which has been produced by clearing the plateau of the lowest terrace of its Forest growth, and thus laying bare the crests of the cliffs. The consequence of this complete removal of the protective covering of timber is, that the cliffs being unprotected for many years by fallen trees, have lost their former terraced and wooded character, and have become (by land slips) clean, bare and shelving, exposing their loose and shifting materials to all the effects of rains and winds. When the lowest terrace was wooded, every tree which fell from the crests of the cliffs either hung by its roots, or was arrested in its fall down the sides of the cliff by underbrush and small trees, and thus became a resting place for those annual slips of earth, trees, pebbles, and even sand, which the thaws of spring set in motion. By such means minor terraces were formed, supported by the strata of blue clay before described, and on these subordinate terraces, grass and shrubs grew and gave a permanent character to the sides of the cliff. In some of the gullies, the retaining and conservative effect of underbrush is still well marked, especially where the forest growth has been permitted to protect the crest; there are, however, but few instances now remaining on the cliffs, for miles have been cleared. Another rather singular consequence is to be found in the quantities of loose sand which are blown up by every gale of wind from the South, South-east, and East, from the bare sides of the immense crater-like gullies which have been formed during the last few years. A gentle breeze suffices to transport the unstable sand of the cliffs up the clean sides of the gullies on to the plateau above. In several instances the writer measured four inches in depth of coarse and fine sand, which had been blown up upon the stubble of last year's wheat. The sand frequently penetrates into the fields for a distance exceeding one hundred yards from the crests of the cliffs, and in process of time will succeed in destroying, or at least very materially deteriorating, considerable tracts of land on the lowest plateau, if not checked in its march. When the cliffs are denuded of their protecting fringe of trees, and, as a natural consequence, of the underbrush which shields their sides, the least streamlet of water rapidly loosens and sets in motion the sand and gravel which form so large a portion of the lowest terrace. The bed of clay arrests this process of destruction for a while, but being itself underlaid by sand and gravel as unstable as that by which it is super-imposed, its conservative influence is of short duration, and in a thousand instances the bare and clean sides of enormous gullies show how rapid is the present progress of their formation and increase.

It is important to mention that occasional traces of long continued persistence are observable in some of tho gullies. Beds of bulrushes of gigantic growth may be seen in some of those whose sides aro still partially protected with underbrush and small trees. Those occur on the lowest bed of blue clay. The blue clay itself sometimes presents precipitous tower-like prominences, which are best seen east of Gates' farm, where tho forest still affords its protection to tho cliffs. It is not, however, only the plateau and tho cliffs which point to the destructive effects which have been produced by clearing away the timber, the beach itself shows by its encroachments how much its boundaries have been increased by tho absence of that annual supply of fallen trees which once checked the inroads of the surges of the Lake. In many parts the sand and shingle present the same features as those which distinguish the peninsula. Formerly the progress of the breaking waves was arrested by multitudes of those natural groynes which Mr. Fleming has so faithfully delineated and described.

The present high waters of the Lake have of course exerted their influence in removing many of the trees which afforded long resting places for shingle and pebbles, but the absence of a continued supply of these protective barriers has enabled the beach to attain and the waves to wash the foot of the cliffs, thus accelerating their downfall. It is also probable that the removal of the boulders and larger pieces of shale washed out of cliff detritus, for building and other purposes, has exerted its influence in assisting the encroachments of the breaking waves of the Lake. Sketch No. 7 may afford an illustration of the appearance and power of these breakers as they dash at an acute angle on the beach during the continuance of easterly and south-easterly winds.

A question of much interest and importance suggests itself with respect to the first or lower terrace. It may be urged that a plateau of the altitude of 160 feet, extending in gradual surface lines in the form of a promonotory, would be a sufficient source of materials and afford the necessary topographical conditions to produce modifications of Mr. Fleming's hypothetical early development of Toronto Harbour as shown by his diagrams No. 9, 10, 11, 12, and 13, and thus in part give countenance to his view of its remote history. Mr. Fleming says, "On the subsidence of Lake Ontario from a high to its present level, the land fell in easy slopes to the water's edge, and the gradual descending surface lines were continued outward under water; the abrupt terminations of the land along the boundary of the Lake having been formed by its encroachment through a long course of ages, the promontories which formerly projected have been rounded off by the destructive influence of the elements."—(Can. Jour., p. 226, Vol. II.)

That an arm of the sea did occupy the region of Lake Ontario and Lake Champlain during the Tertiary epoch there is little reason to doubt. The occurrence of marine shells and skeletons of marine fish (Mallotus Villosus) 540 feet above the sea or 310 feet above Lake Ontario, at Montreal, in the valley of the Ottawa, near Bytown, in the valley of Lake Champlain, and in many localities in the valley of the St. Lawrence, afford ample proof of this vast phenomenon. (Lyell's 1st voyage to the United States, page 119, vol. 2, New York Edition. See also Provincial Geological Reports, Ottawa valley). It has, however, been shown that the phenomena of the highest terrace can have nothing to do with the formation of Toronto Harbour, seeing that it has only been attacked to a trifling extent and probably within the last 50 years. It becomes necessary, therefore, to advert to the period when Lake Ontario, probably as an arm of the sea or a fresh water estuary, stood at an altitudo of 160 feet above its present level, or in other words washed the base of the second or highest terrace. There is every probability that this event extended over a long period of time.

Ridges corresponding to the plateau of the lowest terrace have been described by Mr. Hall in the Geology of the fourth district of New York: "One of tho most interesting of the superficial deposits of the district is the Lake ridge, which from Sodus in Mayno County with some trifling exceptions is a travelled highway, nearly as far as the Niagara River. Beyond this it can be traced quite to the head of Lake Ontario, and I have been informed that it exists upon the northern side of the Lake." In a note attached to the remarks of Mr. Hall on the Lake ridges we find the follow-

ing: "To the geological reader it will require no attempt to prove this the ancient beach of Lake Ontario, or a body of water, perhaps an arm of the ocean, which once stood at this elevation; such occurrences are well known elsewhere; but there are many persons in western New York, and some grave critics among the number, who prefer to explain this by supposing some stupendous uplifting of the strata in this line from Sodus Bay to Niagara River." Further on (page 351) Mr. Hall states that "The elevation of this ridge above Lake Ontario has been variously estimated from one hundred to two hundred feet. In 1838, through the kindness of Mr. Barrett, I obtained the elevation of the ridge north of Lockport, which is about *one hundred and sixty feet* above Lake Ontario."

It is probable that the formation of the New York ridge above described was contemporaneous with the lowest terrace of the Scarboro' heights, and may not the persistant layers of water-worn pebbles described before, as being about ten feet below the surface of the plateau, be the ancient beach of Lake Ontario at its former altitude? Is it reasonable to suppose that when by a slow upheaval of the country, the level of Lake Ontario became comparatively lower and lower, the strata of alternating sand and gravel and blue clay forming so large a portion of the cliffs of the lowest terrace, would have remained persistant, and permitted the land to fall in easy slopes to the present level? Is it not rather to be supposed that its shores would have been terraced and abrupt like those descents which are to be seen about four miles from Toronto, where the lowest terrace leaving the Lake crosses the road from Toronto to Kingston? If this were the case, and there does not appear to be any reasonable objection to the hypothesis, the lowest terrace instead of descending in easy slopes when the land became elevated would form at least two distinct terraces abruptly bounded by declivities of sand, precisely like the abrupt declivities seen on the Kingston road near the eastern extremity of Ashbridge's bay, which are nothing *more* or *less* than the abrupt *sandy shores* of the ancient Lake as the land slowly rose from beneath the bed of a Tertiary estuary or ocean.

Under such circumstances the existence of any promonotory becomes very doubtful, and the coast line would appear to assume an extension commensurate with the former extension of the whole northern coast of Lake Ontario, which in its earlier development extended probably nearly uniformly a short distance Lakewards. The protection afforded by Lake beaches during periods of low water is so great that it may truly be said that the cliffs or bluffs of the coast are only submitted to the denuding action of atmospheric forces during those epochs, an action which tends to give them the form and conditions essential to the growth of vegetation, which, in not a few instances, extends without the occurrence of cliffs or even of quarternary formations to the very shores of the Lake.

Other objections might be advanced against the existence of a promontory or even a considerable extension of the coast of the Scarboro' heights Lakewards since their emergence. Such for example as the great depth of water which exists in the Lake to the south of the Scarboro' heights.

Lieutenant Herbert clearly shows soundings to the depth of 48 feet *within* a mile of the coast, and in one locality, west of the Highland Creek, the great depth of 120 feet is recorded *within* two miles of the coast; what denuding operations can have produced these great depths since the assumption of the present level of Lake Ontario if the land extended Lakewards to a considerable distance, even half of the distance assigned by Mr. Fleming (about two miles—see section and scale) during that epoch? The occurrence, it is said, of tertiary blue clay within two or three hundred yards south of Ashbridge's Bay is another objection which, combined with the known dip of the Silurian rocks in that locality, suggests grave doubts as to the former extension of the land to a degree consistent with the idea of a promontory.*

Mr. Fleming's views of the origin of the delta of the Don are also scarcely consistent with the probable topographical condition of the country, when the Lake assumed its present level. The supposition is not admissable that the country rose from beneath a tertiary ocean (see Geological Reports for 1845–6) in a sudden and violent manner. It occupied, most probably, a vast epoch of time; if it emerged at twice the rate at which Sweden is now becoming elevated, namely at the rate of five feet in a century near the North Cape, and a few inches in a century near Stockholm, (see Lyell's second voyage to the U.S., Vol. II., page 194, New York Edition), it would have required 32 centuries for the hills in Scarboro' Township to have emerged; or if we take the lower and perhaps best defined sea beach, the one of the lowest plateau, 160 feet above the present lake level, it would still have embraced 16 centuries, and this too upon the supposition that the rise was continuous, which is known not to have been the case, as lower beaches testify. During that period, how would rains, snows, and dews drain away from a country "totally devoid of water-channels for surface drainage," as Mr. Fleming supposes when he assumes that the Don *began* to exist when the Lake had acquired its present level (Can. Jour., Vol. II., page 106). The Don, together with all the rivers and streams of any magnitude which now flow into Lake Ontario, *began their existence with* the uprising land and grew with its growth, excavating the valleys through which they now flow to within a few feet of their present level, during the successive epochs of the subsidence of the Lake from its former vast extension. The detritus of the Don and other streams, brought down during higher Lake levels, forming sand-bars and mud-flats, which are now pine clad ridges and the cleared farms of thriving settlers. On the south shore of Lake Ontario the valleys of streams which fell into the Lake when it stood at an elevation of 160 feet higher than at present are plainly visible. Mr. Hall says, "The interruptions in the continuity of the ridge, from the passage of small streams are numerous throughout its whole extent. Many of these streams were doubtless discharging their waters into the Lake at the time of the formation of the ridge, and have thus kept an open passage, others have been closed up during its deposition and formed little ponds upon the inland side, which, subsequently becoming more powerful, have burst through the barrier and carried away large portions of it." (Geology of the 4th District, page 350.)

It is suggested that the term 'delta' is altogether a misnomer, leading to the idea that the River Don has brought down materials from its excavated valley and deposited them at its mouth, and elevated them above the surrounding waters, like the Nile and the Mississippi, only on infinitely smaller scale.

Now, the banks of the Don at its mouth are of tertiary yellow and blue clay, and there was a time no doubt, not very far removed

* See Appendix, Note E.

from us now, when those banks were washed directly by the surges of Lake Ontario. It is abundantly evident that the Don, within the limits of the Christian era, poured its waters directly into the Lake, as the absence of *made land*, which alone constitutes a delta, well proves, without reference to the deep waters of the Marsh, and the absence of that evidence of antiquity which one would expect to find, if the Don had for many ages contributed its detritus to fill the space intervening its mouth and the opposite, though somewhat far removed shore of the Lake boundary of the Marsh.

It is, however, important to inquire what phenomena exhibit themselves at the mouths of rivers pouring their waters directly into the Lake, such rivers, for instance, as the Rouge, the Humber, the Mimico, and the Highland Creek, which are severally larger and smaller than the Don, consequently comprehend either extreme in point of dimensions. It is important to know whether it is probable, or even under ordinary circumstances of wind and weather, possible for the Don to have formed a *bar* (the proper term) as far from its mouth as the south sand beach of Ashbridge's Bay.

The testimony of Mr. Hall is peculiarly appropriate in the present instance. Speaking of bars at the mouths of rivers and streams, he says, "The bar is formed by the influence of two forces—the waves washing in, which carry forward the sand and deposit it in long beaches; and the opposing power of the steady current, which neutralizes that of the waves, and the sand then falls down in a broad curve. The force of the current is principally expended in opposing the waves of the Lake, and becoming diffused, it flows quietly over the bar. This continues while there is no more than ordinary force in the waves, but on the occurrence of a violent north-east storm (i. e. near Genesee) the whole of this bar and perhaps ten times as great an amount of matter is thrown upon the beach, closing the outlet. This remains so long as the wind continues, but as soon as it subsides and the water in the pond is able to force a passage through the beach, the old order of things is resumed to be again subverted and again renewed. Such, simply, is the operation of one stream, as it has existed for the last four or five years, and such would be the history of hundreds of large and small streams along the Lake shore." (Geo. of the 4th District, p. 356.) The knowledge acquired by the inspection of any stream pouring its waters directly into Lake Ontario, shows that it is impossible for a small river like the Don, even if it were ten times as large, to form a bar a mile from its mouth and water to the depth of 18 and 20 feet intervene. Nor is there reason to suppose that the Don was ever a stream much larger than it is at present. Those who are familiar with the cutting action of rivers, first attacking one bank, then by landslips or fallen trees, driven to the opposite bank, will feel fully satisfied that the Don in its present development is abundantly sufficient to explain the denuding action it has exercised since it began to flow with the slowly receding waters of a tertiary ocean.

We may, however, gain some clue as to the age of the marshes of the Don, and the beaches which confine them, by examining other marshes and beaches which have been long under observation. In geological investigations every thing is to be learnt by *comparison*, and he who speculates upon an incident without taking cognizance of similar occurrences must expect to be called upon to furnish a separate theory for every phenomenon, differing in externals from the class to which it belongs.

In describing the ponds, marshes, and beaches which lie to the west of the Genesee river, Mr. Hall mentions a few facts which will enable us to form some idea of the probable age of the 'Delta' of the Don.

"The beach before alluded to between the Lake and these ponds, is nearly a mile long (near Genesee, see Lieut. Herbert's chart,) before coming to the outlet, from fifty to one hundred feet wide, and generally not more than five or six feet above the Lake. *For the last few years* * it has been wearing away (1842) and the roots of large trees growing upon it are becoming exposed, and some of the trees themselves are thrown down."

"Farther westward the space between the Lake and the marsh is five or six hundred feet wide. This is occupied by three distinct ridges, running parallel with each other, and with the Lake. Near the western extremity these three ridges divide into four, but continue equally well marked. Their summits are from six to eight or ten feet above the Lake, and the vallies between them are from four to six feet below the tops of the ridges. The materials of which they are composed are similar to the recent lake beaches, consisting of pebbles and sand covered with a light sandy loam. They are over-grown with large trees of oak, elm, beech, and button-wood, which shows their antiquity. Their form is distinct and well marked, while the cause which gave rise to them *more than a hundred years since* is still active, producing other similar ones before our eyes."

Mr. Hall is contented to limit the duration of the existence of Lake beaches separating marshes from the Lake, and containing far stronger evidence of *antiquity* in the form of large trees of "oak, elm, beech, and button-wood" than any portion of Toronto Harbour beaches, to a period of "more than one hundred years," —(Geol. of the 4th Dis., page 357.)

Further on he says, "I might go on to illustrate the condition of the beaches and outlets further to the west, but these few examples are applicable to the whole. The ridge of beach west of Long Pond is undivided, and in many places from ten to twenty feet high, showing that a variation of a few feet in height can be no objection to the mode of formation."

"For many years previous to 1835 the Lakes were all at a lower elevation, and *this allowed the formation of bars and beaches* at the outlet of streams, which before opened by a deep channel into the lake." Mr. Hall here hints at a condition of things which will be shown hereafter to have exercised a remarkable influence upon the conformation and stability of the marshes of the Don and Toronto Harbour.

One more example will suffice to illustrate the comparatively modern formation of beaches and marshes on the shores of Lake Ontario. "Some of the Bays along Lake Ontario formerly admitted vessels for several miles, while at the present time they are partially or entirely closed. The beach formed at the mouth of Irondequoit bay has a narrow opening of three feet deep, while formerly it was a quarter of a mile further east, and of a depth sufficient to admit sloops which took in freights at the head of the bay *three miles* distant. The bay is so situated that it receives the abraded materials of the banks of the Lake, both from east and west. It is one mile and a quarter wide, gradually narrowing southward; and is separated from the Lake by a sand-bar or

* High water of 1838 equal to that of 1858.

beach, from fifty to two hundred feet wide, and rising from three to twenty feet high. The *greater part* of the beach has accumulated within the last *fifty* years. At that distance of time it was very low, and scarcely covered with grass ; it is now overgrown in some places with large trees. The sand and silt brought down by the streams into this bay are gradually filling it up, and eventually it will become a marsh, with the stream winding through it to the Lake."

From these quotations it is evident that extensive formations, such as beaches from four to twenty feet high, swamps with vast accumulations of vegetable growth far exceeding the Don marshes, have sprung into existence during the last few centuries, adopting a wider margin than Mr. Hall, who merely says, " more than 100 years ago." Now in the absence of any evidence of greater antiquity than that which may be embraced within a period of a few centuries, it does not appear reasonable to *assume* such antiquity, when every existing phenomena may be accounted for by comparison with surrounding and nearly contemporaneous events. It is again urged that the great depth of water (12, 16, and even 18 feet) between the marsh *boundary* and the mouth of the Don, together with the great distance by which they are separated, are geologically, quite sufficient to exclude the idea that any connection whatever has existed between the formation of the one and the detritus of the other. The peninsula beach would have existed in nearly its present form and extent if the Don had never begun to flow. A perfect type of the peninsula, only of larger extent and more complete growth, is found at the Rondeau, Lake Erie. It embraces an area of 6,000 acres of water. The shallowness of Lake Erie readily explains the giant size of this and other similar formations in that Lake; the long swells and tempestuous waves which distinguish that easily agitated Lake are due to its small depth.

It now remains for the writer to explain the views he entertains of the formation of Toronto Harbour, and then proceed to the discussion of those remedial measures which the conditions of the case appear to require. These views are not submitted without due acknowledgement of the great interest which distinguishes the theories of Mr. Fleming and other gentlemen who have recorded their opinions; and the writer would never have publicly appeared in this controversy, if he had not thought it the bounden duty of every one whose thoughts had been turned to the subject, to discuss, to the best of his ability, a question involving the very existence of the City of Toronto as a commercial emporium.

The subject of '*Travelling Beaches*,' is one which has long engaged the attention of Geologists, and is in the present instance of peculiar interest. Sir Henry de la Beche, in the Geological Observer, points to the action of the Sea on coasts in the driving forward of shingle, in a particular direction, by breakers produced by the action of prevalent winds, under the influence of HEADLANDS.—(Geological Observer. page 83. Phil. edit., 1851.) The illustrations given by that eminent geologist, are perfectly applicable to the great North American Lakes, due allowances being made for the height and length, and, consequently, the force of the waves, as well as to the difference in the specific gravity of fresh and salt water.

Mr. Fleming has correctly described the *effect* produced upon the Scarboro' beach, as regards its westerly motion, under the influence of winds impelling waves or undulations over the greatest expanse of the Lake. It is believed, however, that a few points of material importance may be added, by way of illustrating the action of waves on the coast, and the subsequent distribution of the beach they transport. Any wave raised by winds blowing in a direction east of a perpendicular drawn to the general direction of the coast, (see Mr. Fleming's Chart, also, Chart No. 8,) will begin to curve inwards the moment the wave become retarded by the increasing shallowness of the water. The time when this influence on the direction of the wave begins to be appreciable is entirely dependent upon the height of the wave ; for it has been ascertained that a wave *begins* to *break* when it reaches water of a depth *equal to its own height*. (See Reports of the British Association for 1837—Report on Waves.) Its influence upon the bottom is exerted before it attains a depth of water equal to its own height, and the retarding effect of a shoaling coast is felt at some considerable distance from the Shore—dependent, of course, upon the depth of water. These effects give to all waves the curved form shown in fig. 8. But there is another and a far more powerful influenee which gives a curved form to waves as they approach the coast (Scarboro') when the wind is blowing in an easterly direction, or to the North of East. The influence of *protecting Headlands*. The shallowness of the water induces the waves to break when they approach the shore, which they do in the form of a curve, but the influence of a protecting headland is felt long before the wave reaches shallow water on a shoaling coast like that of Scarboro.' The influence of a protecting Headland is extended to waves in water of any depth. By reference to the chart, No. 8, several systems of waves will be seen, some merely curving inwards by their approach to a shoaling coast, others (A, B, C, D, E, F,) curving to a much greater extent under the influence of the protecting headland shown on the Chart. The same argument applies, though in a far less degree, to the waves, P, Q, R, S, which, although coming from the East, will have a *tendency* to move the sand, of the west shore of the peninsula *northwards*, where one would suppose it to be entirely safe from the effect of easterly waves. Sir Henry de la Beche is very precise on this subject, he says " The lines of waves are shown by dotted lines made to curve inwards by protecting Headlands." (page 84, Geo. Ob.) It is urged by the writer that waves driven by belts of winds acting in the direction and position of the arrows, 1, 2, 3, 4, (Chart 8) would be obstructed by the headland at Y, which, when clothed with pine forests, was far more influential than it now is, although now it affords protection to small craft anchoring outside Ashbridge's bay from all winds to the *North of East*. It is well known that the influence of headlands is manifested every where on the sea coast and often gives to certain harbours their value against the destructive effect of particular winds. It appears manifest that a travelling beach from K to Y, would be arrested after it had passed Y, and begin to be deposited at O O O, (See note C. Appendix ;—remnant of an ancient Beach.) Belts of wind 1, 2, 3, 4, could have no effect upon the beach at O O O O, nor would belts 5 and 6, as they would act under the lee of the land. The argument applies, *a fortiori*, to ALL winds blowing from the *North* of *East*.

The origin and formation of the peninsula appears to the writer to have been as follows. At a period far within the Christian era limits, the coast line of the township of Scarboro' and York was continued without interruption round the north shores of Ashbridge's Bay and Toronto Harbour. The Don

flowed then, directly into the Lake like the Humber, Mimico, &c., at the present time, without depositing any more 'Delta,' or bar, than other rivers of its class are observed to do, and exercising no influence whatever upon the formation of any portion of the sand beaches and shoals under consideration. Sand bars would frequently be formed under the influence of the protecting headland, about four miles from Toronto, and as frequently be washed away by storms during periods of high water, their materials being distributed far and wide. With these sand bars pebbles and shingle would be occasionally mingled, and time after time might be deposited from their great specific gravity to form a basis for a permanent sand bar. A period of high water arrives like the one just terminating, like the period of 1838, or of 1788, and during that period a sand bar of larger growth was deposited under the protecting Headland—a period of low water follows, like that of 1819 or that of 1848, and during that period the sand shoal was washed up into a sand beach similar to the sand beaches before alluded to, as described by Mr. Hall, near the mouth of Genesee (see Herbert's Chart,) and of which thousands of their kindred are to be traced on the shores of all the great Lakes, formed under similar circumstances, "more than a hundred years ago."

This beach would undergo numerous modifications according to the height of water, which fluctuates in Lake Ontario to the extent of five feet (some authorities say eight feet), but as soon as its western extremity had progressed beyond the influence of the protecting headland it would be swept round to the north shore, forming the 'spit' from the Peninsula beach to near the wind mill. Now all this might have occurred during one period of low water (a few years), or it might have occupied several periods. It is, however, probable that the beach surrounding Ashbridge's Bay and the Marsh was thrown up and round during one period of low water in the Lake. Now begins the existence of the Marsh, which is described as consisting mainly of a floating bog, but which has been making rapid progress of late years, as a few illustrations will prove. About 250 or 300 yards south of the bridge over the Don, now being built by the Grand Trunk Railway Company, an old brick-yard is seen. (April, 1854.) The clay has been dug out to a depth below the present level of the Don, and the hollows are occupied with reeds, rushes, and swamp plants. A farmer who has resided near Ashbridge's Bay, not two miles from the City Hall (next to Leslie's), stated to the writer that he considered he had lost about five acres during the last thirteen years by the encroachment of the Marsh, but he expected he should regain some of it *when the waters fell.* The remains of a fence at least 60 yards distant from the present boundaries of the rushes is distinctly visible in one portion of the Marsh. These encroachments have been made during periods of high and low water, and arise from the invasion of the land by the rushes and other swamp plants. They are merely presented as modern instances of rapid encroachment, but without relation to the main question.

Chart No. 6 represents a plan of the Peninsula. The dotted lines indicate the longitudinal axes of the beaches which were thrown up one after the other during the progress of the formation. The dotted line No. 19 represents the bar now in the act of being thrown up into a beach by the lowering of the waters of the Lakes, which are now (April 20th) *two feet lower* than in *June last.*

The materials of which the beaches are composed have travelled along the beach of Ashbridge's Bay, impelled by winds and waves before alluded to. The materials originated in the continued destruction of the Scarboro' cliffs. *This portion of the theory of Toronto Harbour is entirely due to Mr. Fleming, to whom the credit of having first given it to the public is unquestionably due.*

It is with some degree of confidence suggested that the several beaches denoted by the dotted curved lines on Chart 6 represent the successive epochs of additions to the Peninsula, and that they are the visible and permanent records of the periods of low and high water which have distinguished the recent history of Lake Ontario. Five beaches are distinctly seen between the lighthouse and the utmost south-westerly extension of the Peninsula.* These may correspond to such periods of high and low water, as are known to have occurred in 1788, 1838, and 1853, and in 1819 and 1848, and probably in 1854 or 5. The question is one of much interest and deserves further investigation.

The history and mode of formation of the Peninsula having been pointed out, it is now proposed to discuss the question whether a permanent opening at the end of the Bay would be a benefit, and first of all, whether such an opening in the form of a canal could be maintained at a reasonable expenditure.

It is manifest that in order to make such an opening permanent, which is evidently the first point to be considered; sand and shingle must be prevented from 'travelling' into it from the east, which would without doubt be the case if no preventive measures were adopted. We are not, however, permitted to assume that an opening in any one part of the Peninsula would *suspend* the operation of those forces which have given a local habitation to the whole beach from Ashbridge's Bay to Gibraltar Point. Assuming that an opening were made, say near the Peninsula Hotel, and that by groynes or other devices sand and shingle were prevented from closing it. It is perfectly clear that in order to effect this result the first object would be to retain the sand and shingle *east* of the opening. Suppose this to be accomplished, what, it is asked, would become of the remaining western portion of the Peninsula? would the sand and shingle there cease to be a travelling beach? would it cease to move westward as heretofore? There can be no doubt that if left unchecked it would progress onward, being still subject to the same controlling forces as before. But if it progressed, the beaches to the west of the opening would be rapidly moved away and form an extensive natural breach, seeing that no advance of materials to *supply their place* could take place, they being preserved to the eastward of the opening for the sake of maintaining it. The Peninsula, under such circumstances, would rapidly become an island, and its extremity near the canal gradually assume the form of the western extremity, throwing out tongues and spits in a northerly direction. But, it may be urged that the sand might be prevented from 'travelling' by means of groynes. It is true that the construction of groynes from the canal all the way to Lighthouse Point at short distances apart, would have that effect for a time, but without they were made very high the sand would mount over them and form dunes, according to laws painfully recognizable in many parts of Europe and especially in the 'Landes' of France as well as on the shores of Lake Huron. (See Sir Henry de la Beche, on this subject, page 84, Geo. Ob.) Again, the groynes would have to penetrate into deep water beyond the influence of waves upon a shoaling

* See Note G. in Appendix.

coast, or how would they check the progress of the shelving beach which is disturbed by the long waves of an easterly gale to a greater depth than fifteen feet?

The Peninsula in its subaqueous extension is an enormous sand and shingle shoal, very shelving on the Lake side, and, where it has not been remodelled or disturbed, very precipitous on the Bay side.* The testimony of the fishermen of the present day in relation to it is the same as when Sir Richard Bonnycastle wrote, it consists Lakewards of immense fluctuating shoals. These shoals extend Lakewards 1500 yards before they attain a depth of 30 feet, except in one spot, and that is near the Lighthouse or Turning Point. Baywards the shoals are in general precipitous, and the openings which have from time to time been made in Asbridge's Bay and the Peninsula, have scarcely changed the precipitous character of the Bay sides. They have merely succeeded in shifting the boundary a little northwards, but they have not materially changed the form of the coast or its subaqueous extension in either Bay. The writer took pains to examine the effect of the waves breaking over about a third of a mile of the coast of Ashbridge's Bay this season (April, 1854), and found along the Bay side of the Beach 6, 6½, and 7 feet water *within* 15 or 20 feet of the bar over which the waves broke furiously, and had been breaking for weeks, under the influence of the easterly gales which have distinguished the present spring. (See Note B. in Appendix.) It is well known that the late breach near the Peninsula Hotel is wholly filled up, and that its effect upon the Bay has been comparatively insignificant.

It will be seen that the arguments against the construction of a permanent opening apply with greater or less force to every portion of the beach from its western to its eastern extremity. A canal from Ashbridge's Bay into the Lake would, *a fortiori*, be still more objectionable than one near the Peninsula Hotel, as it would involve the strengthening of the whole of the beach as far as the Light-house Point to prevent its westward motion. The next question which suggests itself, *assuming* the preservation of the beach provided for, is the possibility of keeping an artificial canal open anywhere between a few hundred yards east of the Point and the most remote extremity of Ashbridge's Bay, without continued and expensive dredging. When we remember that many million tons of sand and shingle have passed along the beach from Scarboro' shore to form in 58 years the 30 acres in deep water beyond the Lighthouse Point, when we glance at the new beach which has recently been thrown up west of the Point, when we consider the changed character of the Scarboro' cliffs, unprotected as they now are, is it probable that a canal could be maintained within the limits before mentioned? Is it not rather to be supposed that the sand would accumulate on its eastern side with a rapidity before unknown and defy the most energetic efforts to preserve a passage during the winter season? The rapidity with which natural breaks fill up, as shown repeatedly in Ashbridge's Bay, and recently near the Peninsula Hotel, furnishes also a safe answer in the negative to this question.

It appears manifest that the integrity of the Peninsula must be preserved; that no artificial Lake communication situated between the Light-house Point and the eastern extremity of Ashbridge's Bay could be maintained under the existing conditions of the Scarboro' cliffs, without an enormous outlay at the commencement and an annually increasing expense in maintaining it.

It is urged that the chief objection to the construction of groynes into only eight or ten feet water is the nature of the sloping beach, the fluctuating shoals, which in places are not twenty feet below the surface of the water seven hundred yards distant from the shore. Mr. Fleming's own measurements opposite his proposed canal give a distance of nearly 700 yards before the shoaling coast reaches a depth of twenty feet water. The whole question of the construction of groynes is involved in a distinct and exact knowledge of the depth to which the surges of the Lake affect the sand and shingle of the shoal. It is manifest that if a groyne were not constructed into water deeper than that in which the waves have the power to move the sand at the bottom, it would be of little avail. Let us suppose for instance that groynes were constructed on the sand bars to the depth of twelve feet water, and that the high waves of the Lake affect the bottom to a depth of fifteen feet.* The sand during storms, namely those which produce the longest and highest waves (the easterly storms) would be disturbed to the depth of fifteen feet and pushed round the projecting groyne, other sand from above or the east, falling down by gravity or pushed along by the impelling waves would fill the place of that which had been removed, and be in turn swept westward, and so on repeatedly. A really useful groyne must penetrate into water of a depth *beyond* the ordinary influence of the waves upon the shelving bottom during storms, which certainly extends on the Peninsula shoals to a depth exceeding fifteen feet. There is a spot on the Peninsula where a groyne can be constructed to serve every purpose required. Mr. Fleming has justly recommended a groyne at the Lighthouse Point (the south-western point of the Peninsula), and it appears to the writer that THAT spot is the first which should be selected for the construction of a groyne. But Mr. Fleming's suggestion that the groyne should be carried out into eight or ten feet water, is altogether incompatible with the effect produced on the sand at the bottom below that depth by the long swell of the waves.

The writer, while duly acknowledging Mr. Fleming's appropriate selection (as it appears to him) of the locality, would suggest that one groyne should be carried out there into 40 feet water. When the peculiarity of the beach and shoal at the Lighthouse Point is considered the magnitude of the work will not appear so imposing as it seems to be at first sight. The boundary of the Peninsula at its south-west extremity is extremely abrupt, so much so, that at the point A on the Chart No. 9, the depth of water is not less than 40 or 50 feet within 400 feet of the beach, (leaving a wide margin for recent changes, possible, but not probable.) The soundings on the Map are taken from personal observation, and Mr. Fleming's Chart, and they indicate a steep and abrupt boundary at the turning point of the shoal. This peculiarity in the conformation of the Lighthouse Point in its subaqueous extension, will necessarily be maintained for a long period of time, as every successive step in advance is into deeper and deeper water. A few hundred yards to the west of the Point, 90 feet water is recorded. (Lieut. Herbert.) All progress of the beach, therefore, in a south-westerly direction must be made by vast accumulations in deep water. This point serves as a protecting headland round which the travelling beach is rapidly moved by easterly winds and as rapidly forwarded northward by south and south-westerly winds.

A groyne at A, bisecting the segment of curvature would, if

* Note H. in Appendix.

* Note D. in Appendix.

run out into 40 feet water, arrest all sand and shingle for a considerable period of time, and as the accumulating materials encroached upon the protecting limits of the groyne, further increase could be arrested, and the materials FIXED, by placing a second groyne at B; in process of time the travelling beach would encroach upon the protecting limits of B, a third groyne placed at C, on a smaller scale, would arrest further progress, and FIX the saud between C and B; a fourth after a few years would be required at D, and so on, as materials accumulated. The results of this system would be the establishment of the Peninsula upon a firm basis, adding year by year a large quantity of what might become valuable property if properly taken care of and embellished with, as well as sustained by, appropriate trees. The western extremity of the Peninsula is also subject to the inroads of travelling beaches as not only its formation but the extension of the sand bar sufficiently shows, and has shown, for many years. (See Gzowski's report, noticed before.) A groyne at E, would, if made to penetrate into 15 feet water, effectually retain the moving beach, and preserve the integrity of the distance between A and E, and finally a groyne at F K, as mentioned by Mr. Fleming, would establish the channel, and if curved sufficiently far in the direction of K, a permanent beach would be thrown up during the next period of low water, which would secure a current in one channel of at least 12 feet water, sufficient to preserve it from possible inroads of sand, which might be deposited in the form of Bars, *within it*, during summer currents, hereafter to be noticed.

In the mean while, what, it will be asked, is to become of the more easterly portions of the peninsula; is there no danger of any part of that narrow strip between the Peninsula Hotel and the extremity of Ashbridge's Bay being swept away? Nature hersel supplies an answer to this question, which, when duly considered may be correctly interpreted. Nature has made and repaired one breach during the past year at the eastern extremity of Toronto Harbour; she has made and is now repairing at the rate of an acre a week another breach in Ashbridge's Bay, of a third of a mile long. There is not a doubt that during the whole epoch of the existence of Toronto Harbour, from its first washed up beach to its present imposing magnitude, breaches have been made during all periods of high water, and repaired during periods of low water. The writer is of opinion that several remains of breaches can be recognised in various parts of the coast between the Hotel and the eastern extremity of Ashbridge's Bay—these remains distinguish themselves by two projecting spits, precisely like those which are now seen where the recently closed breaks existed at the east end of the Harbour. Four years ago—during the period of low water in 1849—several of these remains of breaches could be distinctly seen, bordering the swamps and east of it. It is desirable that breaches should not be made, as by slow degrees they limit the dimensions of the Harbour, but under certain circumstauces, they are of immense importance, as will be shown hereafter. The writer submits, with respect, that no works whatever are required to preserve any portion of the beach from destruction. It will be asked, why not? and it will be urged that the diminution of the beach uear Privat's Hotel and elsewhere, in an easterly direction, to less than one half its width in abou. two or three years, is cause for serious doubt as to its stability The writer would beg to call attentiou to the circumstances under which the beaches became diminished: their diminution is only *apparent*, and where real (if anywhere) it will be rapidly repaired; the beaches expose less surface in consequence of the *unusually high water of the Lake*. The average annual fluctuations of Lake Ontario are about two feet, but the difference between the levels of the Lake in October, 1849, and in June, 1853, was four feet, five inches. (See Canadian Journal, page 27, Vol. 2.) Now it is suggested that these great differences in Lake Levels are of the utmost importance, not only with respect to the general appearance of the Peninsula, but with regard to its subaqueous development. An observer in 1849 would see a broad beach at the Peninsula Hotel some fifty or sixty yards broader than an observer in 1853, solely on account of the difference in the Lake levels, without the necessity of one particle of sand being removed. An observer in 1853 would say the beach is but two feet three inches above the waters of the Lake, while an observer in 1849 would say, it was six feet eight inches above the same level, and yet the real altitude of the beach might be precisely the same. So with respect to Soundings. The bar which in 1853 had four feet water upon it would be two inches above the water in October, 1849. These are important items, they show the absolute necessity of exact scrutiny into all measurements relating to the Harbour, and the reduction to the same standard of Lake level of all observations, before a fair conclusion can be arrived at. The influence of difference in lake levels, in other words, of periods of high and low water upon the Peninsula is all powerful. This difference has enabled sand bars to be thrown up into sand beaches, and has, in a word, been the great *formative* cause of the whole Peninsula. It is beautifully shown even in this tempestuous weather, (April, 1854); at Lighthouse Point the writer noticed in October last the slow deposition of the spit now protruding itself above water at the western extremity of the Point. The Lake was then 3 feet 3 inches above its lowest level in 1849, and the spit was just covered with water in calm weather, and not to be seen from the shore, but easily discernable from the Point.* Now it is decidedly a narrow sand beach, but the Lake is about a foot lower than in September last. During the present, or rather coming summer, as the Lake falls, it will be washed up into a stable, prominent beach, sweeping rouud to the north, and enclosing some additional acres, to mark the present rapid increase of the boundary of Toronto Harbour.

One more aspect under which the fluctuations in the level of the Lakes may be viewed, is in the relation of those changes to the construction of groynes.

It may be supposed, for instance, that during a high lake level a groyne is constructed into 10 feet water—it is known, however, that the difference between the maximum and minimum levels of Ontario exceed five feet (some authorities say 8 feet). It is clear that a groyne penetrating iuto 10 feet water during high lake levels would penetrate into only five feet during minimum levels, which would have the effect of ueutralizing the purposes for which the groyne was constructed. †

This argument becomes perfectly applicable when we consider the nature of the shoals east of Lighthouse Point. There is an immense distance between the lines of 10 feet water and 15 feet water, when reduced to the standard of the Lake levels; this distauce exceeds in many instances the total length which would be required for one groyne at Lighthouse Point, penetrating into

* See Note G, Appendix, (referred to before.)

† See Note I.

40 feet water, (between 300 and 400 feet) thus involving for the construction of effectual groynes east of Lighthouse Point, where the water shallows, an outlay which, if judiciously incurred, would serve to arrest permanently the progress of the sand, give stability to the Peninsula and distribute the expense of future works over a great number of years. It will, doubtless, be becoming in the writer to express more fully the reasons he entertains for the opinion that it is unnecessary to protect the weaker portions of the Peninsula.

1. Vast bodies of water in the form of waves may break upon it, and over it, without carrying any considerable quantity of materials into the bay, as before noticed. This arises from the very *gradual sloping* conformation of the shoals lakewards. They may carry away the crests during high water, but they rapidly repair the breach. The sloping character of the shoals being always maintained by the mode of their formation, and waves always *breaking* when they reach water *equal* to their own *height*, their force is destroyed before they reach the shore. During low water levels, the waves break nearer the shore, the re-arranged materials of the beach are then more precipitous, but during this period the breaking waves exert no force on the crests of the beach, because the emerged land due to falling of the Lake *protects itself.*

2. It is submitted that we have *passed* the maximum period of high water; but, if not, it will occur in June, and before works (supposing they were necessary) could be constructed to protect the weak portions of the beach. It appears quite probable that all period of danger from high water is passed, if we may permit ourselves to be guided by the experience of the past. Mr. Hall, in quoting Mr. Higgins, the Topographer to the Geological Survey of Michigan, embodies in a single sentence the probable state of the case. "He considers it probable that the minimum period continues for a considerable period of time, while the maximum continues only for a single year." * (Geo. 4th Dist.) This summer, doubtless, we shall see the Peninsula apparently extending itself in all directions (as it is already doing) by the subsidations of the waters of the Lake, and then will begin to appear and to be thrown up into beaches, the vast accumulations which have been progressing during the last two years of high water from the unprotected naked gullies of the Scarboro' cliffs.

The answer to the question proposed by the Harbour Commissioners respecting "the effects which have been produced or are likely to be produced by the present breach at the eastern extremity of the Bay of Toronto, particularly with reference to the bar at the entrance to the Bay" becomes very materially simplified by recent events. The first event being the natural closing of the breach, the second event the occurrence of another breach of far more imposing dimensions in Ashbridge's Bay. Assuming that the breach had not been closed, it is manifest that the question of its influence upon the bar at the mouth of the Harbour would involve the action of the *currents* which modify the form of the bar at the mouth. The currents will be noticed hereafter. The question of the breach being *prejudicial* to the Harbour is also involved in the general question of the influence of the currents, and the necessity for strengthening that portion of the Peninsula where the breach existed has been already discussed. It has also been shown that a permanent opening could not be maintained at that end of the Bay without immense outlay, and is consequently not to be recommended. The question of "the advisability or otherwise of enlarging the opening between the Harbour and Ashbridge's Bay" is subordinate to the general question of the currents and will be noticed in the sequel. The construction of a permanent opening into the Lake from Ashbridge's Bay, has been shown to be infinitely more objectionable than the construction of a canal near the late breach east of the Peninsula Hotel, as involving an enormous outlay for the purposes of protecting its mouth and preventing, by groynes, the beach *west* of it as far as Lighthouse Point from continuing to 'travel' under the influence of the same forces as those which called it into existence.

It is submitted by the writer that it is quite impossible to separate the effect of the breach at the east of Toronto Bay on the bar at the mouth of the Harbour from the simultaneous and posterior effect of the breach in Ashbridge's Bay.

Whatever beneficial or baneful results were produced on the bar by the opening near the Peninsula Hotel, have been entirely obliterated by a power of much greater magnitude acting unceasingly during the last five or six weeks, and there seems to be no reason to doubt but that 99 per cent. of the good effects produced by any openings or breaches on the bar, are due to those which have recently occurred in the Lake boundary of Ashbridge's Bay. We can only *suppose* the effect produced on the bar by the opening near the Peninsula Hotel; it cannot now be measured. Observations made in the autumn might have recorded its effect, if any were noticeable, but since the breach was made in Ashbridge's Bay, those effects have been annihilated, or, at least, so greatly remodelled as no longer to be appreciable. The reasons for this statement are as follows:—

1st The opening in Ashbridge's Bay, when the writer's attention was first particularly drawn to it, at the beginning of April, was a third of a mile long, and the waves swept through it with terrific violence, producing a current so strong in Ashbridge's Bay towards Toronto Harbour, that all expectation of distinguishing the effects produced at the bar by the opening near Privat's, (then closed,) were entirely dispelled. At another time, towards the end of April, when a few days of calm weather permitted a close examination of the breach, it was found that the waves still breaking over it, although there was very little wind, produced a violent current, which drove the boat in which the writer was seated, with rapidity towards the swamp. A calculation was then made of the amount of water projected into Ashbridge's Bay by the rolling of the waves over the beach. The distance exceeded 1600ft., over which the waves broke. The height of each wave was estimated at two feet, the breadth between fifteen and twenty feet. Assuming the length, 1600 feet, the height, one foot, the breadth, ten feet, a quantity of water exceeding 16000 cubic feet would be thrown into Ashbridge's Bay by each system of rolling waves. This occurred, on an average, once in twelve seconds, or five times in a minute, which would give 80,000 cubic feet of water every minute.

If the Don were 100 feet broad, ten feet deep, and moved at the rate of one foot a second at its mouth, it would throw into the Bay, 60,000 cubic feet a minute; while the breaking waves over the breach, at Ashbridge's Bay, would, in a comparative calm, throw 80,000 cubic feet at the lowest estimate, into the same general receptacle, during the same time. This number does

* See also Note I.

not, it may be very reasonably supposed, represent one-fourth part of the mass of water projected into Ashbridge's Bay over the low beach, during the long continued easterly storms which distinguished the month of April. It is therefore urged, that any attempt to pronounce an opinion upon the effect produced upon the entrance to the Harbour by the late opening near Privat's Hotel, must be entirely theoretical, as it cannot be fairly represented by soundings taken in April of the present year. It is important, to ascertain, how this mass of water projected into Toronto Harbour by the Don and through the breach at Ashbridge's Bay, distributed itself in passing out of the Harbour entrance. The temperature of the water determines the solution of this problem. Six or eight trials showed the temperature of the water to vary from 38 to 42 degrees, both in Ashbridge's Bay, the Lake, and the Harbour. This is within two degrees both above and below the temperature of water at its greatest density, (39° 6,) consequently, the density of the water may be regarded as uniform, and hence, the current would be equally distributed over the bar at the entrance to the Harbour, modified by a current produced by the easterly gales, noticed hereafter. In summer, it is probable that the surplus water would have escaped, almost entirely, over the bar at the mouth of the Harbour, and would have had little effect upon the channel in deep water. The effect of temperature is beautifully shown in the currents which are established during the summer months at the Harbour entrance, and requires a detailed notice. The most permanent current in the Bay, having an outward direction, is, of course, due to the Don; but the waters of the Bay and Don, being shallow, rapidly acquire an elevation of temperature, by exposure to the sun's rays; their specific gravity is therefore diminished. The deep waters of the lake do not attain the same elevation of temperature, and are, consequently, heavier than the surface waters of the Bay. The warm and light waters of the Bay are pushed out over the bar by the colder and heavier waters of the Lake, irrespective of the current of the Don. The cold Lake water enters at the deepest part of the mouth of the Harbour, and during the summer months establishes an inward current, often remarked. Two other currents of importance are to be noticed;—1st. An under, outward current, which is occasioned by *westerly* winds impelling the waves of the Lake over the bar into the Bay: the same influence, however, pressing upon the waters of the Lake, raises them at its eastern extremity and lowers them at its head. In order to establish equilibrium between the level of the waters in the Harbour and those in the Lake, an outward undercurrent is established, which, in prolonged westerly gales, is very marked. 2nd. An inward under current at the mouth, when easterly winds are blowing, which have the effect of driving the waters *out* of the Bay, and at the same time, raising the level of the water at the head of the Lake; in order to preserve equilibrium, a powerful under inward current is established in the deepest water at the mouth of the Harbour.

It is evident that these currents have given to the sand-bar now threatening the mouth of the Harbour its peculiar conformation, as shown in Mr. Fleming's chart. These *currents cease* to exist during the maintenance of an opening, either in Ashbridge's Bay, or at the east end of the Harbour. Their conservative influence in retarding the progress of the shoal northwards, and its invasion of the entrance of the Harbour, cannot fail to be noticed: they form another objection against the construction of permanent openings in the localities named. The late Mr. Roy, C.E., who, as before stated, paid much attention to the phenomena of the Harbour, well describes the influence of these currents in his paper published in the *Monthly Review*, for June 1841.

It is sufficiently clear that the currents just described, irregular and accidental as they are, and *deriving their very existence* from the conformation and growth of the Harbour, can only be supposed to exercise an influence, (and moderate in its effects,) upon the *form* of the sand-bar which threatens the mouth of the Harbour.

An effect requires a cause: the cause of the currents is the presence and form of the peninsula, without which they would not have existed; the currents are destroyed by destroying the integrity of the peninsula. It follows, as a matter of course, that the currents could not have produced that which has given birth to them; an hypothesis which, in spite of the contradictions it involves has yet found supporters.

The writer presumes that the Harbour Commissioners will permit such an interpretation of their words, "Means to be adopted for the improvement and preservation of the Harbonr," as to allow the introduction into this Report of remedial measures which have not been specially referred to in their published notice.

The suggestions which the writer begs leave to submit are introduced, without present comment, into the following recapitulation of the statements advanced in relation to the history, formation, and preservation of the Harbour.

1. The Harbour, in its utmost extension, is altogether a modern formation.

2. Its formation is due to the present existing PROTECTING HEADLAND of the west commencement of Scarboro' Heights.

3. Its original form was a sand-bar, or shoal, deposited under the protecting headland, in a position a little to the south of its present situation. The materials of which the sand shoal was composed were derived from the east, being impelled by easterly winds during a period of high water, and then washed up into a beach during a period of low water.

4. The Don exerted no influence whatever on the original formation or extension of the sand beach, but the beach was extended westerly, under the headland, by the same causes which originated it, until it advanced so far as to be removed from the influence of the protecting headland. Subsequently, it was swept round in a northerly direction, more particularly by south and west winds, until it enclosed the space now occupied by the marshes of the Don and Ashbridge's Bay.

5. The whole valley of the Don was excavated ages before the enclosure took place, and the marshes have been produced by the same vegetable growth which now converts the ponds of the peninsula into reedy swamps. (Witness the ponds south of the Lighthouse, during the present generation). The detritus of the Don has accelerated the formation of its marshes, but that detritus consists only of the fine mud which can be mechanically suspended in water.

6. The peninsula proper has been formed by "travelling beaches," impelled along the boundary of the present Ashbridge's Bay and its westerly extension. There is every probability for supposing that each successive beach, as shown by the dotted lines on Chart 6, and Sketch 10, are permanent records of *Low Lake Levels*.

7. The boundaries of the Peninsula have been immensely extended during the last 58 years, and the addition of so many acres in deep water beyond the Lighthouse implies the *subaqueous extension* of the shoals forming the sloping Lake sides of the Peninsula to a very considerable degree southwards.

8. The materials have been obtained by the destruction of the Scarboro' cliffs. (Mr. Fleming.)

9. The operations of settlers during the last forty years in clearing the crests of the cliffs in Scarboro' have occasioned the immense recent destruction there visible, and have produced to a great degree the alarming progress of the Peninsula boundary of the Harbour.

10. Previously to the settlement of the country the cliffs were much protected from atmospheric influences by trees, under-brush and grass growing on their crests and down their sides, and the beach by natural groynes of fallen timber, also by the large fragments of shale and boulders washed out of the drift, which have been removed for building purposes.

11. The progress of the travelling beaches may be arrested by groynes. (Mr. Fleming.)

12. The groynes must penetrate into a depth of water beyond the influence of the great waves of the Lake upon the bottom, and the maximum and minimum level of the Lake must be taken into consideration in ascertaining the depth to which they ought to be constructed.

13. The effect produced upon the beach by waves washing over it, or in some instances creating openings, is merely to change its position and move it a few yards to the north; this is a consequence of the vast extension of the sloping beach southwards.

14. There is no danger of a *permanent* breach being made by the waves of the Lake.

15. Breaches are due to the concurrence of storms and high Lake levels, and no breach would have been made near the Peninsula Hotel during low Lake levels.

16. Evidence tends to show that the maximum level of the Lake lasts for one or two years only, whereas the minimum lasts for several years. The maximum level of Lake Ontario for the present period was attained very probably in June last, when the level was 4 feet 5 inches above the level recorded by Captain Lefroy in October of 1849 at the Queen's Wharf. There is a remote probability of the level this year being equal to what it was last year, owing to the late severe winter. This is a point which will soon be ascertained. The level (end of April, 1854) is now two feet one inch lower than in June last.

17. In order to preserve the Harbour from closing, a groyne must be constructed at Lighthouse Point into 40 feet water, which will cause the sand to 'back up' against it and extend the dimensions of the shoal southwards; in a few years a second groyne must be constructed at B on the Map, and after another interval of time a third groyne at C, then at D, (each groyne being smaller than the preceding one), and so on. The effect of this system of groynes will be to extend the shoal southwards into deeper and deeper water, and gradually 'back up' the progressing materials TO THEIR SOURCE, thus immensely strengthening the Peninsula and making it a permanent and stable tongue of land. The sand may be prevented from forming dunes by planting trees, beginning with the formation of new land and planting as the *land forms*. (If groynes were to be constructed first, say at the Hotel and then westward, it would be necessary to plant the whole coast at once, which would be a difficult matter).

18. Simultaneously with the construction of a groyne at A, a groyne into 15 feet water must be constructed at EM, and simultaneously with this a groyne at KF. (Mr. Fleming.)

19. It is most desirable to produce a current between the Queen's Wharf and the groyne. In order to effect this object the Don must still be permitted to enter the Bay, but not by its present mouths. They should be closed and a mouth opened at H, and a channel cut for the Don south-east of the Railway Bridge. Two or more channels would be better, for the purpose of preventing the cutting of a deep passage by the waters of the Don; the channel might be conveyed to different parts of the Marsh. The progress of consolidating the Marsh by this means would be very rapid. The waters of the Don would then percolate through the Marsh, and if they cut a deep channel they would have time to deposit much of the mechanically suspended matter with which they are charged during freshets, and if they did not cut a new deep channel, the reeds would act as filters, like the reeds in the swamps bordering the Mississipi, (see Lyell's 2nd voyage to America), and effectually arrest all silt. The sewage of the town should be made to flow into the Don; in the Marsh it would become inoffensive, being rapidly consumed by vegetation. The waters of the Bay would thus be greatly purified. The passage of the Don through Ashbridge's Bay *could not be maintained.*

20. Any permanent opening in the form of a canal between a few hundred yards to the east of Lighthouse Point and the eastern extremity of Ashbridge's Bay could not be kept open, without the construction of works into deep water, and of groynes into deep water *east and west* of it.

21. But ONE POSITION for the mouth of a *permanent* canal exists on the Peninsula, and that is at Lighthouse Point, where it should be carried out side by side with the groyne into 40 feet water. The groyne might form one side of the canal. A canal from the Bay terminating there would retain a permanent opening for ages, if groynes at B, C, D, &c., were constructed as the 'land made' time after time.

22. A canal constructed from the point G to A, and the continuation of the groyne at K to G, would soon inclose a piece of land which would amply pay all the expenses of the undertaking, (to be used for the sites of warehouses, storehouses, &c.,) and maintain the integrity of the Peninsula, and the preservation of the permanent opening into the Harbour throughout the year. See Section No. I.

23. In process of time, which might be materially shortened by the construction of simple works, a junction from A to E would be advisable, and thus form a permanent island.

24. If the entrance at the Queen's Wharf were narrowed simultaneously with the construction of the canal from A to G, both openings would remain permanent and unobstructed by bars.

APPENDIX.

NOTE A.

The materials of which the Peninsula beach consist are derived almost altogether from the drift clay and sand of the Tertiary epoch. Precisely the same materials, as regards their mineralogical character, are found to compose a very large portion of the Scarboro' cliffs. The materials consist of—

1st. Very coarse quartz sand.
2nd. Red Felspar.
3rd. Black magnetic oxide of iron.
4th. Comminuted calcareous shale, derived from the breaking up of larger fragments found in the blue clay.
5th. Pebbles of quartz, syenite and various other kinds of granite, such as are found in abundance in the drift sand and clay of the Scarboro' cliffs.
6th. Water-worn and rounded fragments of shale, containing fossils belonging to the Hudson River Group; some of these fragments are four and five inches in diameter, and one inch thick.

The shale and pebbles constitute a very considerable proportion of the materials composing the Peninsula and are found in abundance at Lighthouse Point. They must have come from the East and 'travelled' along the beach. The specific gravities of some of the sand materials are given below, the figures will probably be conclusive as to the possibility of such heavy substances, and of a magnitude which may well confer on them the appellation of 'very coarse sand,' being transported from the *west*, in the absence of powerful currents to propel them through water from 30 to 90 feet deep. (Between the Humber bay and the west frontier of the Peninsula :—)

Gneiss	2.72
Syenite	2.74
Granite from	2.62 to 2.74
&c.	&c.

Out of 40 kinds of rocks mentioned by Sir Henry de la Beche in his "Researches in Theoretical Geology," only *four* have a specific gravity less than 2.50, or two and a half times heavier than water.

The fossils of the Lower Silurian rock found on the Peninsula are derived from the drift clay which reposes immediately above the rock itself. They may be seen, *in situ*, in very many situations near Toronto.

Ice cannot have transported the Peninsula materials from the west, for then we should find *boulders*, of which none are to be seen.

But one rational conclusion remains, which is that they have come from the *east*.

NOTE B.

The late Mr. Roy, C.E., of Toronto, paid considerable attention to the phenomena of Toronto Harbour. He describes it as follows: "The Harbour of Toronto is about 2¾ miles in length from the Government Wharf to the Peninsula Hotel, and about 1¾ miles in breadth from the end of Church Street to the southern Peninsula. The water deepens gradually from the North Shore. At the distance of 1000 feet from the shore it is about 15 feet deep, and at the distance of about half a mile from the shore it is 30 feet deep; further out it deepens to 33 feet, and continues to maintain these depths for about a mile further, when as we approach to the southern Peninsula, the depth suddenly declines from twenty-eight and thirty feet water to five, six, and seven feet water. The greatest depth at the entrance is 14½ feet, and the width of deep water from the Government Wharf to the buoy is about 800 feet." This was published in the Monthly Review, June, 1841.

NOTE C.

The writer would respectfully suggest to the Harbour Commissioners the propriety of a personal inspection of the Scarboro' coast from the east corner of Ashbridge's Bay to Gates' Farm. The wild and romantic beauty of the scenery will well repay the fatigue of the trip. It must be accomplished on foot, and in order to obtain a clear insight into the phenomena of the coast as connected with the formation of Toronto Harbour it must be commenced at the east end of Ashbridge's Bay.

The points to which the writer would respectfully direct attention are,

1st. The nature of the beach at Ashbridge's Bay, and in many instances the very regular *attitude* assumed by the shingle under the influence of the late easterly gales. That attitude consists in the inclination of each piece of shingle with respect to its neighbour, the one to the east reposes as it were on the one to the west of it, and so on, as exhibited in the diagram. In several instances the writer lately observed this arrangement, evidently made under the influence of easterly breaking waves.

2nd. Attention is called to a remarkable *remnant* of an ancient beach, about a mile east of Ashbridge's Bay. A fence of a cleared field is in one part placed upon it. Trees of considerable growth are still remaining on it, showing its antiquity. The beach or spit has the form indicated in the diagram.

3rd. Natural groynes of fallen timber occur in this locality and afford a good idea of the extent to which the fallen timber may protect the cliffs.

4th. The configuration of the coast is especially to be noticed where the first or lowest terrace approaches the Lake. It will be seen that this terrace, especially when fringed with the tall pines which once covered it, would serve all the purposes of a vast protecting headland from north-easterly and easterly gales, to the present Ashbridge's Bay, and, in the writer's opinion, the first origin of the peninsula was due to this protecting headland.

5th. The enormous gullies are to be particularly noticed, their recent formation, the unstable nature of the materials of which the cliffs are composed, and the certainty of an immensely rapid yearly increase in the quantity of material precipitated into the Lake by the falling of the sides of the gullies.

6th, The identity of the mineralogical character which exists between the sand of the cliffs, the beach sand, and the sand of the peninsula.

7th. The influence of the total destruction of protecting forest growth on the rapid formation of gullies.

Other subjects worthy of note are embodied in the accompanying Report, and do not require to be noticed here.

NOTE D.

"From the experiments made by the Committee appointed by the British Association, in 1836, it was found that with a depth of water equal to twelve feet, waves nine inches high, and four or five feet long, did not sensibly affect the water at the bottom. Waves from 30 to 40 feet long, oscillating at intervals of six or eight seconds, produced some effect, but much less than near the surface."—(See Article *Waves*, in the *Penny Cyclopedia*, vol. 27).

"The agitation of the sea is felt at different depths, in proportion to the magnitude of the waves raised by the friction of the wind. During heavy gales of wind, the depth at which this agitation has been observed, sufficient as it was to shake up fine sediment enough to discolour the water, is about 90 feet."—*Geological Observer*, page 112,

"The depths at which the disturbing action of a sea wave can be felt has been estimated even so high as 500 feet on the Banks of Newfoundland."—*Emy. Movement des Ondes.* Quoted by Sir H. de La Beche.

The writer is persuaded that the long waves of Lake Ontario, formed by the friction of the wind on an expanse of water equal to 180 miles, are sufficient to move sand at a depth of fifteen feet, especially on a shoaling coast. The construction of groynes on a shoaling sand beach is open to the objection that the groyne itself may occasion such a *reflex* action of the waves as to bring sand from depths where it is affected into deeper water, thus producing *secondary shoals.*

NOTE E.

The writer does not advance this statement as founded upon indisputable authority. He has heard it stated by persons employed in collecting stone and wood from the Scarboro' coast, that blue clay is found in ten or twelve feet water, outside Ashbridge's Bay, and affords good anchorage ground. On questioning the fishermen in that locality,

they said they had *not* observed it. The question is not one of importance, nor has the writer had any opportunity of verifying any statement by personal inspection.

NOTE F.

During the present spring the writer endeavoured to discover the ancient beach of Lake Ontario, alluded to in the text. At the depth of two feet, on the borders of the marsh, he found, repeatedly, a washed sand, but did not succeed in finding shingle and pebbles. The high state of the water prevented any search being prosecuted far in the marsh, at a depth of three and four feet.

NOTE G.

In October, 1853, the writer sketched the appearance of the ridges and new reef, at Lighthouse point, from the summit of the lighthouse, of which, Diagram No 10, is a representation. The diagram does not pretend to the accuracy of measurement. It was sketched at that time with a view to illustrate, at some future period, the theory of the formation of the Harbour advanced in this Report.

NOTE H.

The Bay subaqueous extension of the peninsula has been remodelled and disturbed in many parts, this arises from a circular current which sweeps round the south shore of the Bay, towards the bar at the mouth, when westerly and south-westerly winds press the waves on to the north shore. Equilibrium is established by means of this current, which is, of course, dependent upon the force of the gales from the quarters mentioned. The late Mr. Roy, C.E., notices this current in the paper before alluded to.

NOTE I.

The late Dr. Houghton, State Geologist of Michigan, took the level of Lake Michigan, in 1819, as his Zero of Comparison, and he noticed, in subsequent years, the following variations in the level of that Lake:—

LEVEL OF LAKE MICHIGAN.

Years.	ft.	in.	
1819	0	0	Zero of Comp.
1830	2	0	
1836	3	8	
1837	4	3	
1838	5	3	
1839	3	11	
1840	2	7½	

(*Report of the State Geologist of Michigan*, 1841.)

Approximate Estimate for the construction of Works for the preservation and security of Toronto Harbour.

	£
Groyne at Lighthouse point, about 400 feet long, into 40 feet water	3000
Groyne at E. M., into 15 feet water, estimated length, with allowance for Low Lake Levels, 50 chains	2000
Groyne at mouth of Harbour, 100 chains	4000
Total	£9000

	£
Estimated Expense of constructing a *Canal*, into 40 feet water at A, and 20 feet water, at G; approximate length, 1900 yards, width 200 feet	15000
Construction of Groyne from K to G, 100 chains	4000
Total Expense, including Canal and Groynes	28000
Amount of available Land enclosed by works between the points A. G. F.........250 acres: 250 acres at £100 per acre	25000
Difference	£3000

REPORT
ON THE PRESERVATION AND IMPROVEMENT
OF
TORONTO HARBOUR,
BY SANDFORD FLEMING, CIVIL ENGINEER.

[*The second premium of Seventy Five Pounds was awarded to the author of this Report.*]

TO THE CHAIRMAN OF THE COMMISSIONERS OF TORONTO HARBOR:

SIR,—A public requisition has been made for information as to the means which should be taken for the preservation and improvement of your Harbor, by a notice dated March 14th, 1854, and a pecuniary reward has also thereby been offered. This last, although perhaps insufficient in itself to an elaborate examination of the subject, is doubtless an additional incentive to all who may chose to compete for it; but to one who is proud of, and takes delight in, those pursuits collaterally related to his profession, the pleasure derived from an enquiry so interesting as the formation of that singular breakwater bounding your harbor is in itself inducement sufficient; and I am fortunately in possession, by previous and independent researches, of information enabling me to approach it with some degree of confidence, and I accordingly submit the accompanying copy of a paper laid before the Canadian Institute about four years ago, which you will be pleased to consider as preliminary to this report.

Toronto Harbour—Its Formation and Preservation.

Read before the Canadian Institute, June 1st, 1850;
BY SANDFORD FLEMING, C. E.

The origin of the now wealthy and flourishing City of Toronto is, in common with that of many other cities and towns, clearly traceable to certain natural advantages possessed by their localities. A waterfall or rapid stream, the navigable termination of a river, or its junction with a lake or other open navigation, will frequently account for the position of a town or village in an agricultural or manufacturing district; but a natural harbour of easy access will generally, if not universally, point out the locality of a thriving commercial nucleus, in all countries open to settlement and civilization.

To none of these circumstances except the last can we attribute the origin of Toronto. We have no waterfall,—no navigable river—even the soil itself is comparatively barren, and for several miles around, with a few isolated exceptions, unsuited for agricultural purposes. To the last, therefore, must we ascribe the beginning of Toronto, and to the unequalled excellence of this harbour forming on the north shore of Lake Ontario, the most facile outlet for the productions of the back country, is principally due the rapid and uninterrupted progress in commerce and wealth of the western capital. To maintain this harbor

in its original state, or, if practicable, to improve thereon so as to ensure a continuance of prosperity, becomes, therefore, of the utmost importance.

The natural basin formed by a sandridge extending from the western boundary of the township of Scarborough, embracing in its arms a portion of the great Lake, possesses many of the requisites for a good harbour; it encloses about 1200 acres of water, entirely free from rocks and shallows, and averaging from 15 to 35 feet in depth, on the wide expanse of which the whole shipping of *all* the Canadian Lakes might safely ride at anchor. During the prevalence of certain winds, however, the basin is not of easy access to sailing craft; and not only is the channel scarcely sufficient to admit the entrance or departure of large vessels, but it is even fast closing up, and, astounding as the assertion may appear to some, will, ere many years, unless efficient means of prevention be taken, put a complete stop to all navigation—a bold enough statement, but from ascertained facts a proper inference.

That the entrance to the harbour is fast closing up, I have been led to discover, by comparing a series of careful measurements recently made, with old charts of various dates. In the sequel, this important fact will be clearly shown, and an attempt made to account for it; in the meantime, it may be sufficient to state that a bar has encroached so much on the channel, as to make it not more than half the width it was fifteen years ago. With the view of prescribing an efficient mode to prevent the further accumulation of shoal calculated to prove so detrimental to the future prosperity of the city, it is first requisite to ascertain the cause of the evil, from whence it arises, and investigate the manner of its action—hence the following inquiry into the formation of the Peninsula and Harbour.

Few persons visiting Toronto for the first time but are struck with the singular appearance of the neck of land or peninsula stretching out into the lake in front of the town, so low that the few small trees growing at wide intervals on its surface appear almost springing from the water, and on a nearer approach, so long, so curiously shaped, and so different from the land on shore, that many are doubtless led to theorize a little on its formation. Some, who have probably arrived in the province by way of Niagara, and crossed over with their minds filled with contemplations of the mighty cataract, at once, and without much consideration attribute to the descending torrents of that river, the power of elevating from the depths of the lake, or of carrying across in suspension, the drift deposited here—a theory wild and incapable of defence, though some are bold enough to venture it.

Others again, who have probably arrived from the west, or whose business takes them frequently in that direction, and from the steamer generally calling at the mouths of the various small rivers emptying into the lake between this and Hamilton, may be induced to think that these streams have had the effect of drifting the debris of the uplands outward, which, with the assistance of an imaginary eastward current of the lake, is carried until meeting a contrary current, supposed to be of the Don, then the matter held in suspension is supposed to have been deposited at their junction line, opposite Toronto. The advocates of this theory have yet to prove that such currents of the lake as these exist in reality: although it is true that currents outward and inward, over the bar, are found, occasionally resembling a slight half hourly tide, yet, if they have any effect on the bar at all they must have a tendency rather to diminish than increase the deposit. All these streams, with the exception of the Don, enter the lake nearly at right angles, and it is impossible that they can flow into a large and deep body of water, such as exists between their mouths and the point in question, without being entirely diffused; nor could the drift brought down by them be carried wholly or chiefly in one particular direction without a most powerful current, but would, if ponderous, be deposited at their outlet, and if light, would be distributed far and wide. More especially is it reasonable to infer that the Peninsula is neither now affected in any way by these western streams and the imaginary currents in conjunction with them, nor *has* been formed by their drift, since the material composing it, sand and gravel, could not, in accordance with existing laws, be held in suspension and transported for miles over still water, 60 and 100 feet deep. Were the deposit or any part of it of an argillaceous nature, there would have been some slight reason to think that these streams might have been auxiliaries, but such is not the case.

Others, again, suppose that the Peninsula is merely a narrow ledge of rock, slightly covered with the sand and gravel which we find on the surface, but this opinion is quite at variance with the general geological features of this part of the country, and to local investigations.

A little consideration of the subject will show that these opinions can only be advanced by those persons who have merely been enabled to make cursory observations, and by those who, knowing the wonderful transporting power of running water when confined, as in a river, are inclined to attribute to its agency more than is justly due, and overlooking the change of circumstances, class effects universally which can only be produced by causes under particular conditions. They being anxious to account for certain results, are contented with a superficial and fallacious reasoning, and assign to the most conspicuous agents of nature, that, which after a more careful and deeper search would be ascribed to a power less easily observed, but not less active, or less potent.

Sir Richard Bonnycastle, in an elaborately drawn up Report, dated 1835, gives it as his opinion that the Peninsula "was one of the many ridges deposited at the bottom of a vast lake which existed before the present Ontario and Erie were formed out of its drainage," and "that it had not materially altered for a vast length of time, probably not since it emerged from the waters."

It may be thought presumptuous in me to present anything in opposition to the judgment of that respected and eminent gentleman; but from careful observations and measurements, and a comparison of these with surveys made at different times by others during the last half century, having found that the deposit both above and under water has received additions so extensive, and which so closely resemble in character its older portions, I may be permitted to suggest, instead of the Peninsula being a sedimentary deposition of the tertiary periods, as thought by Sir R. Bonnycastle, that the whole of it belongs to the present era, and that at least one of the agents of its formation, is at this day as actively engaged in changing and enlarging the outline of the deposit in question, as it has been hitherto in gathering together the materials, and modelling them into its present shape.

I shall first endeavour to show that the inferior portion or base of the Peninsula has been washed from the valley of the Don by that river at an early date; second, that the materials composing the superior and more recently formed portions have been gradually transported along the shore from the eastward, and that this westward progressive motion of the sand and gravel beach is now the sole cause of the extension and enlargement of the Peninsula, and of the danger at present threatening the entrance of the Harbour.

First—That the groundwork of the Peninsula enclosing the Harbour is, or has been, a delta of the River Don.

It is generally believed that at one time Lake Ontario stood at a higher level, and covered a far greater area than it at present occu-

pies. A barrier may have then existed at its outlet, where probably the Thousand Islands are now seen, over the top of which the primeval St. Lawrence flowed; this great river, rushing over the barrier with tremendous velocity, would, through course of time, wash away its softer parts, and leave standing those numerous isolated rocks and picturesque islands which, now covered with foliage, adorn so much the landscape of that section of the country. If this be not the approved way of accounting for the lowering of the level of the waters, a gradual upheaval of the land generally, or even a subsidence of the ocean may be brought forward; it is unnecessary for our present purpose, however, to enter into a geological disquisition on this point, if we allow that the whole of the country bordering on Lake Ontario was at one time submerged under the same extensive sheet of water; and that the level of this great lake, or it may be this arm of the ocean, was through course of time depressed, and its outline contracted until it was reduced to the present Ontario. A supposition so strongly supported by the discovery of several ancient beach lines, terraces and parallel ridges in the vicinity of Toronto and other parts of the country, at various, but corresponding levels, that it may, without much difficulty be admitted.

As the land gradually emerged, its appearance would be bleak in the extreme; a flat or but slightly undulating surface unbroken by rivers or ravines, and uncovered, for a length of time with vegetation; on the ancient shallows of the great lake various kinds of plants would, through course of time, take root, grow up and wither; the continued reproduction and decay of which would gradually coat the surface with organic matter, and thus enriching the soil, enable it to produce more luxuriant vegetation. Now, (prior to the settlement of the country,) after a lapse of many centuries, we find the great hardwood forest growing over soils of an argillaceous character, and the ancient *sand shoals* of the great lake clothed with lofty pine.

We can easily imagine the general character of the present shores of Lake Ontario, when they first became dry land—a vast undulating plane ascending as at present from the Lake into the interior, but totally devoid of water channels for the surface drainage—here a bed of clay—there a tract of sandy soil; and as it is only reasonable to suppose that rains fell in those days as at present, the water produced by them on the surface, in flowing from a higher to a lower level, would most easily wash out channels in the softest material; and these little streams, collecting together in their downward course towards the Lake, would form the commencement of a river course.

The newly formed rivers, having the same fall towards the Lake as the surface itself, their beds being but slightly under it, would be much more rapid than they are now, and rushing down with violence after thaws and heavy rains, would, proportionally with their greater rapidity, during the first years of their existence, be more effective in scooping out the sand drift, and transporting it to the Lake; from year to year the water channels would thus grow larger and larger, and although the rivers, as they were depressed, lost much of their force and rapidity, yet continually undermining the banks and transporting the debris downwards, would, through course of ages, form those deep ravines in which many of them now flow.

That the rivers in this section of the country have originated in this manner, is inferred from the fact, that they are found almost universally to flow in flat-bottomed vallies or ravines, the banks of which are the abrupt terminations of the level country on each side; and that these ravines are generally found where the drift is of a light and sandy nature.

The accompanying section across the River Don, taken a little above the Cemetery, will show clearly the first proposition; the second also is established by the well-known character of the soil of which the banks are composed. The surface of the country extends for miles to the right and left of the river without any material change of level, except where broken by a secondary ravine of a tributary stream. Doubtless, then, the inference is correct as far as regards the Don, and that the dotted line stretching from bank to bank on the drawing, was the surface prior to the scooping out of its channel.

Section across the Don about $1\frac{1}{2}$ miles from its mouth.

a. The valley of the Don about a $\frac{1}{4}$ of mile wide, and upwards of 100 feet deep—the river here is on a level with Lake Ontario.

b. A tributary of the Don, running through Yorkville, it is cut obliquely by the section and forms a junction with the Don about $\frac{1}{2}$ a mile further down.

The dotted line is about 120 feet higher than the Lake, and the surface maintains very nearly the same level for a long distance on either side in a direction parallel to the shore, with a gentle slope at right angles to it—on part of this slope the City of Toronto is built.

Nor is the Don singular in these respects; of all the streams I am acquainted with to the east and west of Toronto, the same scooping out of the ravines can be shown, and generally the same sandy character of the country immediately traversed, as indicated by the dark green belts of pine running into the interior of the country through the hardwood forest which flourishes better on the heavier soils. And here, without digressing much from the subject, one can scarcely avoid observing very apparent marks of design—the adapting of the pine to grow on soils unfitted for cultivation, and the leading of rivers through pine-bearing soils, thus enabling the settler to take advantage of the various properties of running water in conveying and preparing the most useful of all timbers for his manifold purposes.

The valley of the Don is from a quarter to half a mile in width, with abruptly rising banks, from 100 to 200 feet and upwards in height, the scooping out of which implies the removal of many hundred millions of cubic yards, a quantity so immeasurably great when brought into comparison with the agent of removal—a stream (when not dammed up) only about 50 feet wide, that it appears altogether irreconcilable with the inference drawn; more especially is it so, when we know that the annual quantity of matter brought down by the Don is at present inconsiderable. If, however, we bear in mind that, without assuming a greater volume of water to have flowed in its channel than now, the transporting power of the Don must formerly have been very much greater by reason of its greater descent and rapidity; and, if it can be shown that many ages have elapsed since it first came into existence, the conclusion come to may be taken as rational and correct.

It may seem difficult—nay, almost impossible—to estimate, however roughly, the time which has elapsed since the Don commenced to flow; but if we can arrive at the age of any other river emptying its water into Lake Ontario from a source equally high, the problem is solved. When the great Lake already mentioned, subsided from its high level, then, and not till then, did the Niagara, the Don, and other cotemporary rivers make their appearance. Since that epoch the Niagara has cut a deep channel for seven miles through the solid rock; its annual recession has been ascertained approximately, and from these data its age has been roughly determined. "We may turn to the deep ravine," says Lyell, "and behold therein a chronometer measuring rudely, yet emphatically, the vast magnitude of the interval

of years which separate the present time from the epoch when the Niagara flowed at a higher level."

Thus, then, the Don, coeval with the Niagara, has flowed, according to this great Geologist, for a period far too great for the imagination to comprehend, and which one can scarcely ventureto name by years;* even allowing that our historical knowledge of the past condition of the Falls is far too meagre to estimate with any degree of precision, the rate of their retrogression in former ages, yet we cannot but arrive at the conclusion that the chronological age of the Niagara and consequently of the Don, must be so enormously great, that one would think even its fractional part would suffice for the removal of the hundreds of millions of yards of matter by the latter river to the Lake, without calling to its aid any unusual phenomena.

Having thus shown that sufficient time may be granted, the Don therefore supplies an adequate cause for performing and completing long since the work assigned to it; year after year during its early history, slowly but constantly hollowing out a channel and removing the former contents of its valley to the lake, the lighter and more soluble matter being held for some time by the water, to be distributed far and wide, the heavier particles on the other hand to be deposited near its mouth, in the form of an extensive shoal or delta—the base or ground-work of the Peninsula, on which again to be deposited a drift from other causes and from another source.

Second, That the Peninsula proper has been formed solely by the mechanical action of the waves, that the sand and gravel of which it is composed have been by this action gradually transported from the eastward and deposited on the deltaic shoal of the Don, and that the delta has thus been raised above the surface of the water and extended westward far beyond its original limits.

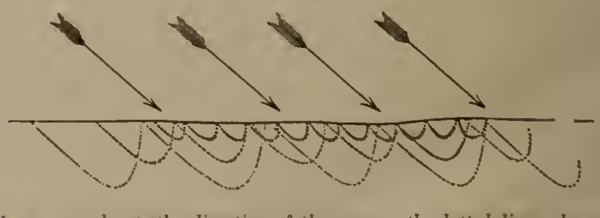
The effects produced by waves on a shore exposed to their action are of various kinds, depending in a great measure on the nature of the beach, the direction of the waves, and their mechanical force: if the shore be of clay the action is entirely destructive, the banks are undermined and continually caving in, the fine argillaceous particles are taken up by the water, carried out and deposited after a time at depths unaffected by the motion at the surface: if the shore be of sand or gravel the effects produced are quite different. When the direction of the waves is not at right angles to the beach a progressive action results, and when the waves break point blank on the shore line with sufficient force the action is destructive, in which case the banks are broken down and the spent wave returns loaded with sand to be deposited outside of the breakers in the form of a shoal generally parallel to the coast; if the soil of which the banks are composed be a mixture of clay and sand the action is both destructive and progressive, the clayey particles are washed out and deposited in still water, while the sand, gravel, and stones are left behind to be moved forward either in one direction or another, and at a rate depending solely on the strength of the impinging waves, and the gravity of the materials themselves. On a rocky shore the effects produced are precisely similar, although of course to a much more limited extent; by continual exposure to the wearing action of water and weather a mass is undermined and tumbles down, a portion of the debris is put in progressive motion during every storm when the waves impinge otherwise than at right angles to the shore line, and is moved, according to the locality, in a certain prevailing direction, until meeting a projecting point or other hindrance to its onward progress; thus forming those shingle beaches seen at many places on all rocky shores.

The effects of the destructive action on banks of clay can be traced wherever the shore is entirely of that material; the owners of property along many parts of Lake Ontario can bear testimony to its annual encroachments; and, to come nearer home, many citizens of Toronto must have witnessed the gradual alteration in the form and recession of the clay banks between the old and new garrisons.

The effects of the progressive action can also be witnessed at many points on all the lakes; but at none in a more remarkable degree than at Toronto, although at other places to even a much greater extent. And since to the peculiar motion of sand and gravel beaches will be attributed not only the extraordinary changes the Peninsula is at present undergoing, but even the greater part of the entire formation, it will be necessary to explain fully the nature of it, and give the reasons why the beach should have a tendency to move in one direction in preference to another.

Let us take an example when the direction of the wind forms an acute angle with the shore, a particle of sand resting on the surface is driven forward up the inclined plane of the beach in the direction in which the wave itself moves, the particle either remains at its now elevated position or (as is more usual) sweeps along in a small curve and rolls downwards with the expended wave to a new position, the distance of which from the first will be in proportion to the mechanical force of the wave and its direction; another and each successive wave drives the particle forward in a similar manner, unless by accident it finds a resting place behind some obstruction or be buried by other particles on the same mission as itself. If we take instead of a grain of sand, a small pebble, we find that the same wave, or a wave having the same force, moves it a less distance than it does the sand, that larger pebbles being heavier make proportionately less progress, and that stones still heavier are moved only when the waves have considerable power. All of these bodies, however, when within the impelling force of the wave and placed in positions fairly exposed to its direct action, seemed to be governed by the same law, and are moved forward a less or greater distance according to their weight and gravity.

Fig. 2.



The arrows denote the direction of the waves; the dotted lines show the paths of grains of sand and pebbles.

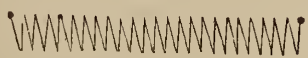
The zig-zag direction taken by the sand and gravel on the beach is indicated by the various dotted lines on Fig. 2, the smallest one is intended to show the course of a grain of sand, and the two largest lines that of pebbles varying in size. The progressive motion is slightly suspended between each wave, but although intermittent is continued so long as the seas break on the shore from the same quarter, and until the moving mass meets with an obstruction, or by reason of a

* "Mr. Bakewell calculated that, in the forty years preceding 1830, the Niagara had been going back at the rate of about a yard annually, but I conceive that one foot per year would be a much more probable conjecture, in which case 35,000 years would have been required for the retreat of the Falls, from the escarpment of Queenston to their present site, if we could assume that the retrogade movement had been uniform throughout. This, however, could not have been the case, as at every step in the process of excavation, the height of the precipice, the hardness of the materials at its base, and the quantity of fallen matter to be removed, must have varied. At some points it may have receded much faster than at present, at others much slower, and it would be scarcely possible to decide whether its average progress has been more or less rapid than now."—*Lyell.*

sudden bend or other peculiarity of the shore line is deposited in a position beyond the influence of the waves.

When the waves impinge at right angles to the shore the progressive motion of the beach is theoretically nothing, the various particles of sand are rolled upwards and downwards, changing position only laterally or in the line of direction of the waves; when the waves impinge somewhat less than a right angle the grains of sand move along in a sharp zig-zag line, as

Fig. 3.



in Fig. 3, when much less than a right angle the particles move onward in a long undulatory line as in Fig. 4. The distance between the points of each indentation being in proportion to the cosine of the angle formed by the direction of the waves and the line of the shore.

Fig. 4.

Granting that the direction of the waves is governed by that of the wind, it follows that whenever the wind blows from a quarter to the right of a perpendicular to the shore, the beach sand is moved to the left, and *vice versa.* If, therefore, the wind blew with equal strength and during equal times from all points of the compass throughout the year, and the waves also had at all times the same mechanical force, the sand would at one time move to the right, and at another time an equal distance to the left; but, to speak in general terms, the beach would remain ever as it was (excepting the effects of the destructive action). Since the forces never could act simultaneously, we would have, it is true, a constant repetition of complicated motions, zig-zag, undulatory, lateral, progressive, and retrograde; but, from their assumed equality and the equal times of their application, there could be no resultant. The mean velocity of the wind may properly enough be taken as equal throughout the year from all points of the compass, since the actual difference, as obtained by observations, will effect the results inappreciably; but the mean force of the waves will not in consequence be equal, as this is greatly influenced by the locality. It is found that the mechanical force of a wave depends chiefly on the strength of the wind and the extent of open water traversed; allowing then that the wind blows equally from all points, it will follow that the resultant of the aggregate forces of the waves impinging at any particular place, will be a line lying in a direction opposite to the largest area of open water.

In applying this conclusion to the beach in front of Toronto we find that the greatest extent of Lake Ontario passed over by winds blowing from any point westward of the perpendicular A B, Fig. 5, does not exceed forty miles, nor is the area of water over twelve hundred square miles, while to the East of A the

Fig. 5.

waves have a fetch of as much as a hundred and eighty miles over an expanse of water measuring nearly nine thousand square miles; hence then (the duration of the action being taken as equal in both cases) the intensity of the collective forces of waves impinging at A from the eastward is many times greater than those from the westward, and the motion of the beach at A must therefore be westerly; it must of course move with a variable velocity because the forces are not constant; its path, or rather the path of each particle, undulatory, since the forces act impulsively on the plane of the beach in combination with gravitation; it must sometimes retrograde since the direction of the forces is ever changing, and they never act simultaneously; but aggregately, the beach sand, subject to many complicated motions, and acted on by innumerable and incalculable forces, must move absolutely from east to west, and (taking the forces on each side of line A B respectively as positive and negative) with a velocity proportionate to their algebraic sum.

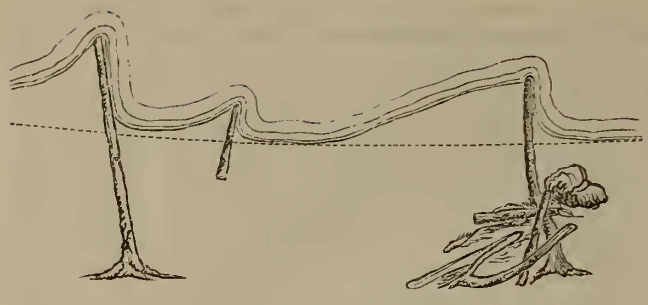
On that portion of the beach successively washed by the waves only, can the progressive motion be proved occularly, yet doubtless a similar action must be produced between the breakers and the main land all along the shore, and when we consider that the lake is seldom or never entirely at rest, that even during perfect calms, unless continued for several days, a gentle ripple capable of moving sand is found on the shore, throughout the whole year, therefore, must the materials composing the beach be continually changing place, and although sometimes moving easterly, yet generally, as proved above, in the contrary direction.

Fig. 6.

The accompanying drawings of natural groynes very strongly confirm the conclusion here come to. They are copied from sketches recently taken (1850) on the spot, between Privat's Hotel and the Scarboro' Heights. Fig. 6 was formed by the falling of a tree opposite a fisherman's hut east of the Narrows on the passing log: the outer end of the tree was supported by its branches: about one half of the log was floating, but kept stationary by the tree; the remaining half rested on the surface, and enabled the sand to accumulate at its easterly side. Figs. 7 and 8 appear also to have been formed in a similar manner. They were found on that part of the shore between Ashbridge's Bay and the Scarboro' Heights. The dotted lines indicate what

Fig. 7.

Fig. 8.



Sketches of natural Groynes.

was supposed to be the original water-mark. In all cases, the water was from one to two feet deep on the westerly side of the logs, and in several instances the sand was five or six inches above their upper surface on the easterly side. These groynes, formed by accident, show very clearly the results of the westward motion of the beach, and, although simple in the extreme, are natural models from which may be designed other contrivances for the retention of the moving sand, and will be referred to hereafter in treating of the preservation of the Harbour.

In addition to these indications of the westward motion of the beach, it may be observed that, on an examination of the mouth of several small streams discharging into the lake east of Ashbridge's Bay, it is found that, whatever be their general direction inland, so soon as they intersect the sand beach, their course is westward. In most cases they run parallel to the shore, separated from it by a small ridge of sand, and ultimately discharge into the Lake some distance west from the point where they leave the woods.

We have also palpable and positive proof of the westward motion of the beach in the extension of the Peninsula itself in that direction. Joseph Bouchette, late Surveyor-General of the Province, made a survey of Toronto Harbour in 1796, a reduced plan of which was published in 1815 along with his work on Canada. At tho date of the survey, that part of the Peninsula on which the Lighthouse is erected was then the margin of tho lake. Since that time, one sand ridge after another has been washed up, until now, after a lapse of only fifty-four years, a tract measuring upwards of thirty acres has been added, and the Lako is now distant from the Lighthouse about eighteen chains.

The general appearance of this recent addition to the Peninsula resembles so closely other older portions, and its geological character is so clearly identical not only with tho adjacent parts, but also with the whole formation, that we may very properly infer they are each and all produced by the samo causes. Admitting, then—and it is indisputable—that this enlargement of the Lighthouse point is due to the progressive motion of the beach sand through the mechanical agency of the waves from tho eastward, wo come to the conclusion that the whole Peninsula is the result of the same action, continued through past ages, and traceablo to the same eastward source.

Arrived at this conclusion, we aro now naturally led to enquire whence has tho abundant supply of material for so extensive a deposit been obtained. About five miles east of Toronto, a high bluff, known as the Scarboro' Heights, stretches along tho shore for several miles. The bluff is about three hundred feet high, and is chiefly composed of sand, with at intervals a stratum of clay. It is known by the farmers residing in tho neighbourhood to recede ten or twelve feet annually at the present day. Farther eastward, the coast has a low aspect, and is of a soil capable of providing but little of the substances of which sand and gravel beaches are composed. Moreover, by contouring the country bordering on this high cliff, it is found that the lines betoken a former great projection lakeward, of which Fig. 9 (see plates) is an ideal outline, and Fig. 16 a sectional sketch on the line K L, at right angles to the shore. For these reasons, then, we are induced to fix upon this point as the locality from whence has been drifted the materials forming the deposit in qnestion.

Founded on demonstrative and probable evidence, here in part set forth, I will now venture to lay before you what I believe to be a correct theory of the gradnal formation of that singular deposit which has provided for Toronto so good a harbour.

On the subsidence of Lake Ontario from a high to its present level, the land fell in easy slopes to the water's edge, and the gradnal, descending surface lines were continued outward under water; the abrupt terminations of the land along the boundary of the lake having been formed by its encroachments through a long course of ages, the promontories which formerly projected have been rounded off by the destructive influence of the elements. The sand clay of which they consisted, and which lay between the ancient and present margins of the water, having been removed to other parts, the clay carried out and stratified at the bottom of the lake, and the sand formed into new deposits, kindred to the one under discussion.

Referring to Fig. 16, we have an illustration of this as applied to the Scarboro' Heights. K represents the present position of the cliff, and L the supposed former shore of the lake, the point of land extending from K to L, Fig. 9, having been removed by the waves.

Figs. 9, 10, 11, 12, and 13 are sketches of the deposit at several periods prior to and during its formation. The first shows the supposed original outline of the lake immediately after its subsidence, prior to any encroachments or changes of the shore line; the second, a small spit running westerly from the Scarboro' promontory; the third and fourth, farther extensions of this spit, and wearing away of the promontory. At this period (Fig. 12) the River Don has brought down a large quantity of drift from its valley, as explained in the first part of this paper, and the lake deposit is now going on over the shoal water. Only a small portion of the spit thrown up at this period now exists, the remainder having been encroached on and moved westerly as the heights at Scarboro' receded. The portion referred to is a narrow ridge running landward to the west of the Don. It may now be seen stretching from near the wind-mill outward, and separating the marsh from the Harbour.

Fig. 13 shows still further encroachments on the land at Scarboro' the almost entire removal of the spit shown by Fig. 12, and the advancement of the Peninsnla westward.

Fig. 14 represents the present state of the deposit. The dotted lines are contours, (explained on the plate,) showing the rapid progress of the shoal landward at the western boundary of the Harbour. Its edgo between the point of the Peninsula above water, and the mainland, at the Queen's Wharf, may be taken at the ten feet waterline, within which it immediately rises, and gives a depth of about four feet only along the eastern side, and from six to thirty inches along its western boundary.

Figs. 17, 18, 19, and 20 are sections across the Harbour and Peninsula, on the lines G H, E F, C D, and A B, drawn on Fig. 14. These show clearly, without unnecessary explanation, the nature and limits of the deposit. Fig. 20 runs from the foot of George Street southerly, through that point of the narrows proposed for the eastern entrance to the Harbour, hereafter mentioned; Fig. 19 on a line parallel to the first, from the Parliament Buildings southerly; Fig. 18 from near the Queen's Wharf directly across the shoal at the entrance: this, as well as the last, cuts several of the many ridges of sand, with long narrow

ponds between, by which the upper surface of the formation is characterised. Fig. 17 runs from the old French fort parallel to the other sections, intercepting no portion of the deposit, but passing very close to its western limit at the Lighthouse point, in sixty feet water. The depth of water increasing as the deposit was extended westerly, accounts very satisfactorily for its spreading so much towards the north. Although an equal amount of sand may annually have been brought forward, yet, as the deposit was forced out into increasing depths of water, this rate of extension westerly would in proportion be deminished, thus allowing the southerly waves more and more time to act in moving the deposit towards the north.

In the manner above explained, it is argued that the Peninsula has been formed, is still undergoing great changes, and is even now receiving large annual additions from the same source. It seems, too, from what will shortly be laid before you, that the same natural agents which have raised up a breakwater, and formed one of the most capacious harbours on the Lake, are as actively engaged in its destruction, by fencing in, as it were, the whole smooth water basin they have made, and justify the inference that, if left entirely to themselves, will at some future period unite the Peninsula to the mainland west of the Queen's Wharf, in the same manner as it was originally connected by the ridge from near Privat's to the Windmill. This stage of the deposit is illustrated by Fig. 15, at which period the surplus water of the Don would in all probabitity find egress over the bar by a shallow channel, fluctuating in position as well as depth during every southerly gale, or by such gaps as are occasionally opened in the narrow belt of sand separating Ashbridge's Bay from the main Lake.

The progressive motion of the beach, observable only on close examination, and apparently of little moment, is when continued during incalculable periods of time, thus proved to be productive of very extraordinary results. Nor is it confined to this neighbourhood, for we discover unmistakeable indications of its operations along the shores of all the great inland lakes.

Round Lake Ontario its effects can be traced at Burlington Beach, the mouth of the Niagara River, Presque Isle, Cobourg, Port Hope, Windsor Bay, and at innumerable points along the east and south boundaries of the Lake.

Round Lake Erie we see its results at Sandusky Bay, Point aux Pins, Long Point, Port Colborne, Buffalo, and at Erie.

At Saganaw Bay, Thunder Bay, Riviers aux Sable, north and south, at Nottawasaga, and the Christian Islands, on Lake Huron.

Round Lake Superior we also have many examples of a like kind; at Fond du Lac, a gravel beach resembling in a marked degree, both in appearance and position, the Burlington beach, near Hamilton. At the mouth of the Bad River, and at Point Iroquois, also, are found beach formations.

Many of these closely resemble in outline the Peninsula at Toronto. Some of them are kindred to the hypothetical stage denoted by Fig. 15; all of them are identical in geological character, and exemplify the working of one of Nature's ever active agencies, co-existent and co-extensive with the lakes themselves. One fact which very strongly confirms the theory of the formation of the Peninsula here propounded, is worthy of notice: all the examples above mentioned invariably conform with the rule laid down—the trend of the deposits bearing in a direction opposite to the longest fetch of the waves, or the largest area of open water traversed. The entire absence of boulders is also very remarkable, and whenever gravel forms part of the drift, the largest size is generally found nearest its source, the finest kinds being at the greatest distances. This circumstance is explained by Fig. 2, and the accompanying remarks, which show that small bodies are moved onwards with the greatest facility. Large boulders, in consequence of being able to resist the mechanical force of the waves, remain at rest, and therefore can form no part of beach formations.

To arrive at a knowledge of those changes more particularly referred to, which have taken place on the shoal at the mouth of the Harbour, I have with permission carefully examined the old maps and charts in the Surveyor-General and Ordnance Departments; many of them are wanting in detail, and in this respect of little service to the inquiry; others are of considerable value, the most reliable of which appear to be the charts of Bouchette, Bayfield, and Bonnycastle, dated respectively, 1796, 1828, and 1835; for although they do not profess to much nicety of detail, yet emanating from these sources we have no reason to doubt their general accuracy. Fig. 2 shows the position of the shoal at the several dates of these charts, and as it now exists; the soundings have reference to its present state. I have much to regret being as yet unsuccessful in procuring a copy of one very old chart, the possession of which would be invaluable, seeing that it is without doubt the earliest record of Toronto Harbour in existence. This chart is said to have been made by a corps of engineers who accompanied the first pioneers from France, nearly 200 years ago. A copy, perhaps the only one on the Continent, was unfortunately destroyed with the Parliament Buildings in Montreal, in 1849; the original is supposed to be deposited in a Jesuit College in Paris.

On comparing the charts of Bouchette, Bayfield, and Bonnycastle, with my own from a recent survey, showing the state of the Peninsula at the present time, we obtain results as follows:—

First, that the channel between ten feet water lines was,

In 1796 about	480	yards wide.
" 1828 "	310	"
" 1835 "	260	"
" 1850 "	120	"

Second, that the quantity of sand deposited at the south side of the entrance by an approximate estimate is as follows:—

From 1796 to 1849-50 nearly 660,000 cubic yards, being in 53 years about 12,400 yards per annum.

From 1828 to 1849 nearly 235,000 cubic yards, being in 21 years about 11,200 yards per annum.

From 1835 to 1849 nearly 155,000 cubic yards, being in 14 years about 11,000 yards per annum.

The alarming progress of the shoal landward is from these figures very apparent. Fifty-three years ago the entrance is shown to have been four times its present width, and fourteen years ago more than double, thus decreasing at the rate of from seven to ten yards annually, by the deposit of about 11,000 cubic yards.

If such be the case, and it is founded on the most authentic information relative to the past condition of the Harbour as yet in our possession, we have substantial reasons for believing that if left unheeded it will in ten or twelve years be inaccessible except to the smallest craft.

The extension of the shoal may be attributed to the same causes which are proved to have formed the whole Peninsula. The beach sand having reached the Lighthouse point cannot by reason of the great depth of water, as shown by the contour lines, Fig. 14, make much progress in extending the Peninsula from thence westerly; there is therefore nothing or at least not much to prevent the southerly waves from acting in full play, they having a fetch of forty miles in opposition to the northerly immediately off the land, and washing along the bar (scarcely under water) towards the north "dump," as it were periodically, large quantities of sand into the channel.

Certain outward and inward currents occasionally exist at the entrance, caused probably by gales slightly varying the level of portions of the lake, or, as it is also supposed, by local variations of the atmospheric pressure on its surface; these may assist to a limited extent in prolonging the existence of the channel, but from all the observations I have as yet been able to make, they appear to be surface currents only, having little or no appreciable effect five or six feet under water: even this supposition therefore is very problematical.

ITS PRESERVATION.

Having by sufficient evidence set forth the probability if not the certainty of an early destruction of the Harbour by the damming up of its entrance, we may now proceed to the practical, and so far as the commercial interests of Toronto are concerned, the vitally important part of the inquiry, and endeavour to obtain a satisfactory answer to the query—How can such a catastrophe be obviated or indefinitely postponed? A problem which becomes of comparative easy solution when the immediate cause of the evil is set beyond a doubt, and the nature of its operations clearly ascertained.

To keep those Harbour channels subject to obstruction from moving sand-bars in a navigable condition, three expedients are generally resorted to: First, continuous or periodical dredging; second, the application of a scour to remove the bar as it is formed; third, the construction of such works as are calculated to prevent the deposition of the sand in the channels, by retaining it at a distance, when its source is known, or by diverting it to those points where depth of water is not essentially necessary.

The first is often applied as a temporary remedy, and as such may at times be viewed as a fit expedient, but to employ it as the lasting counteracter of a constantly increasing evil, is to adopt an indubitable source of unceasing attention and endless outlay; it should accordingly be dreaded as a permanent restorative, and employed only by compulsion from unusual difficulty in the application of other measures that are generally less costly and always more satisfactory.

The second is obtained at *marine* ports by taking advantage of the tidal fluctuations, and is generally produced twice each day by using the currents of rivers at low tide, or by holding up the sea water in large artificial basins at flood, then concentrating and guiding it to the bar at ebb. The impracticability of procuring a scour on Lake Ontario from tidal fluctuations must be admitted, since practically there are none; true it is we have a gradual rise and fall of about two feet annually, and at times successive oscillations in level to the extent of several inches, much resembling small tidal waves; but the latter although they give to the surface water at the entrance of the Harbour a perceptible current, are too rare and too feeble to be of any real value. Nor have we at Toronto a river sufficient for the service; for the Don has hitherto failed to keep open its own channel to a greater depth than two or three feet. Indeed I feel quite convinced that all attempts on these inland waters to keep permanently open those harbour channels much exposed to beach drifts by other than the largest class of rivers must sooner or later prove ineffectual. The currents of the Nottawasaga, of the Sable, and of the Saugeen, are unable to keep open to a sufficient depth or width the mouths of those rivers, and yet they are in volume from ten to twenty times greater than the Don.

The third remedy can always be advantageously employed in cases when the obstructions are the natural results of moving beaches, and when the works are located and executed with proper care they usually answer a good purpose; the second is often after great outlay under favourable circumstances of doubtful efficacy. In the case of Toronto, even if we had at command a current capable of removing the sand on its arrival at the point of the shoal, I question very much if it should be considered as more than an auxiliary, since it would of necessity tend to spread the deposit, and thus, although injuring the channel in a less degree, would impair the Harbour generally by lessening in depth the approach to it. Without doubt the steps likely to confer the greatest security, and hence the most advisable to be taken, are those which are calculated to keep the drift at a distance from that point where it is not wanted.

I therefore beg leave to submit for your consideration the following preventive and remedial measures:—

1st. That a Groyne should be constructed at the Lighthouse point from the shore outward to 8 or 9 feet water for the retention of the moving sand, on the principle of those very simple natural ones shown by Figs. 6, 7, and 8.

2nd. That an auxiliary Groyne be run westerly across the outer edge of the shallows, a little to the south of Gibralter point.

3rd. That a Pier or breakwater be built along the south side of the channel as shown on Fig. 21, increasing the navigable water to six hundred feet, by cutting off the point of the shoal north of the proposed line of pier.

The third alone would probably suffice for many years to keep the channel perfectly free from deposit; but the sand, if not retained at the Lighthouse point, would as at present be moved northward by the southerly waves, and would gradually accumulate to such an extent as to fill up the whole space along the south side of the pier until ultimately rounding its extremities. To effectually prevent this the first and second should also be constructed, the first would divert the drift westerly into deep water, where the navigation could never practically be obstructed; and the second groyne placed about midway between the first and third would have the effect of counteracting all progressive action along the west end of the Peninsula.

If the destruction of the Harbour entrance, and the formation of the Peninsula generally, be satisfactorily determined, I think it is equally conclusive that these works, or works of the same character, would, if established in due time, be exercised to a very beneficial result—the preservation of the Harbour for an indefinitely long period.

There are other evils, which, if they affect the salubrity of the city more immediately than they prove detrimental to the Harbour, are not on that account of the less consequence. The Don annually transports even at this day considerable quantities of silt from the interior of the country to the Marsh, and, during freshets, a portion escapes from thence into the Harbour through the openings in the beach between the Wind-mill and Privat's, tending of course, when deposited in the basin, to lessen its depth. All the drains and sewers empty into the bay, making it, in truth, the grand cess-pool for a population of probably 30,000 inhabitants, with their horses and cattle. The sewers of necessity bring down no inconsiderable portion of solid matter, imparing greatly the purity of the water in the Harbour, as well as gradually lessening its depth. This evil, increasing in a proportionate ratio to the growth of the city, might be greatly ameliorated, if not almost totally removed, by the construction of a main sewer along the whole city front eastward to the Marsh. Into this sewer all the lateral ones from the north, and the drainage of gas, chemical and other such like works should be made to discharge. The feculent mixtures produced would thus be collected and conveyed to a distant point, where, by similar operations to those now ripening in Britain, which will strip them not only of their noxious, but even of their offensive characters, might be profitably converted into a marketable commodity of the highest value to the farmer.

The prejudicial effect of the Don on the depth of the Harbour may also be destroyed by closing its present outlet, and forming an opening of sufficient capacity in the beach separating the main Lake from Ashbridge's Bay.

All proposed works relative to the improvement of the Harbour should be carefully considered before any be proceeded with, lest some of them may interfere with preservative measures, or the general improvement of the whole. It may not be out of place, therefore, to consider briefly another proposition, which, for many years past, has engaged public attention perhaps more than any other in connexion with the Harbour, viz., the forming of an eastern entrance.

Judging from the following paragraph extracted from the *Courier* newspaper, dated 5th March 1835, the project was seriously talked of fifteen years ago:

"Cut across the Peninsula.—A respectable meeting of the friends to this measure was held on Thursday evening at the Commercial Hotel, when a Select Commitee was appointed to request the Governor to name an Engineer, and also to request the Mayor and Corporation to name another, to meet him for the purpose of reporting on the probable result of the cut. The Committee waited on his Excellency this morning, who very readily named Captain Bonnycastle, at the same time expressing a hope that a measure so adapted to promote the health of the city would be carried into effect. His Excellency also promised to do all in his power to put the entire Marsh at the disposal of a company, with a view to its being reclaimed as far as it is possible to do so. There is every reason to expect that the Corporation will take the same view of the case; and if the report of the Engineers shall be favourable, a number of wealthy merchants and others in the city have expressed their intention to take up a sufficient quantity of stock to complete the undertaking."

A few months thereafter the following was gazetted amongst the Notices of Public Improvement:—

"TAKE NOTICE.—The Inhabitants of the City of Toronto will make application to the next session of the Provincial Parliament to incorporate them into a company for the purpose of opening a Ship Navigation through the neck of the Peninsula between the Lake and the Bay of Toronto.

"Toronto, August 1st, 1835."

It is unnecessary to say that the contemplated improvement has not been carried out. The spirits of the projectors were probably damped, and their stock-book laid aside, after the opinions of the engineers appointed to examine were made public. I have only been able to obtain the perusal of one of these documents, but am informed that the report of the gentleman appointed by the Corporation was even less favourable.

Captain Bonnycastle says, relative to cutting a navigable canal through the Peninsula:—

"If this should be done without due consideration, the barrier which nature has interposed for the preservation of a Harbour formed probably by the cutting action of the Don when it was a larger river, which it only requires to look at its banks to convince one's self that it anciently was, will be thrown down, and the Harbour entirely destroyed.

"The reasons to be assigned for this opinion are as follows:—

"The southern face the of Peninsula, a low ridge of sand, is bordered to some distance out, excepting near the Narrows, by large and fluctuating shoals, well known to the fishermen, who have so recently established a profitable trade on them.

"The force of the easterly and westerly gales on these shoals and the bounding shore is tremendous, as every person in Toronto has frequent opportunities of hearing, even at the great distance which the city is from them.

"Should a navigable canal, without due restrictions, be cut through the slender belt which divides the waters of the Lake from the basin, all the millions of tons of large shingle, small rounded and angular fragments of granite and other hard rocks which line the beach will be put in motion!—will break down by their erosive power any barrier opposed to them!—will carry before them the whole extent of the Narrows, and perhaps penetrate through the ponds, fill the basin, and convert it into a fresh sand bank." This he goes on to show might be produced by a current through the canal, and further states, "It might in fact tear away all the strip of beach along the western or bay shore of the great Marsh, and let the whole of that body of the mud of ages into the basin.

"It is argued that all this may be avoided by running out extensive piers into the Lake, and forming a strong embankment along the Ontario face of the Narrows. These, if placed in such situations as to break off the strength of the easterly or westerly swells, will do much towards it, but it will be also necessary to make the canal of stone, to puddle its sides to a considerable thickness or extent, to make it narrow, and to place gates both at its entrance and exit.

"With these precautions there can be no harm in trying the experiment."

Although entirely concurring with Captain Bonnycastle in the expediency of closing up the present outlets of the Don, and of conveying the whole sewage of the city to the Marsh; yet having already, with all due respect, expressed my reasons for differing from the view he takes of the formation of the Harbour, and since conclusions on this point affect directly and very materially the consideration of all works of improvement immediately connected with the Peninsula, I may also be permitted to entertain opinions not altogether coinciding with his as to the probable effects of the proposed south-eastern entrance, and its mode of construction.

Knowing the nature of the action of the beach at the proposed site of the canal, and I think it is established beyond a doubt, there can be no possible danger of any part of the Peninsula being torn away, or the basin within being filled up with sand, if proper steps be taken to counteract such action. This action is chiefly the progressive motion of the beach, which would effectually be suspended for many years by the piers of the canal themselves, constructed with crib work in the ordinary manner. The canal need neither be narrow, as suggested, nor provided with gates, since the former would increase the danger in entering, while the latter would add to the cost and inconvenience, and no benefit could result from either.

Fig. 22 shows the proposed position of the canal Its extreme length from 13 feet water in the Bay to 17 feet in the Lake, is 1600 feet, with a width of 300 feet. The eastern pier presenting an obstruction to the motion of the beach westward, would, acting as a groyne, retain it permanently at its eastern side; the western pier, on the other hand, would be exercised to a similar result in suspending the retrograde motion. The sand gradually accumulating in the space north of the lines A B and D C would thus strengthen the Peninsula at its weakest point, and remove any danger which may be feared from the destruction of the narrow separating ridge between the Lake and the Harbour. The entire destruction of the Isthmus, although hypothetical, is nevertheless a contingency advisable to guard against. Openings have repeatedly been forced through the ridge bounding Ashbridge's Bay by gales point blank on the beach: these, having a destructive action only, might produce a similar result here. If at the same period the base of the Scarboro' Heights became partially protected from the fury of the waves by the lodgment of an unusual number of trees, or the falling of boulders from the cliffs above, the supply of sand from the east would for a time be diminished, the gap would remain open, and liable to be widened by every southerly wind. The Peninsula would thus be converted into an island, resembling its kindred formation "Long Point" on Lake Erie.

Through course of time (roughly estimated at about 20 years) the sand accumulating east of the canal would reach the line A B and ultimately round the piers. Then it would be necessary to make another provision for its retention. A groyne on the line G F would effect this object, and retain the sand for another period, until it reached as far as the line E F. The canal might thus be kept open by repeating the construction of groynes like E F and H K, *ad infinitum*, from time to time as necessity required; or the same purpose may be affected by simply extending the eastern pier as the sand accumulated outward along its eastern side.

The canal, having thus the effect of widening the Ithsmus and removing all probability of its destruction, would, besides being a great accommodation to sailing craft in adverse winds, and to *steam vessels at all times*, likely enough prove of service in another respect. The purity of the water in the Bay is ever liable to be impaired by the vessels in dock, and its close proximity to the city. The canal would provide an additional opening for the ingress and egress of the slight tidal wave formerly referred to, doubtless presenting greater facilities for the renewal of the water in the harbour on its occaisonal fluctuations in level.

From certain simple and well-established premises it has been my purpose to draw reasonable conclusions, which in recapitulation may briefly be stated as follows :—

First, That the foundation of the Peninsula enclosing the harbour may be attributed in its early stages to the debris of the country traversed by the Don, in conjunction with a drift from an ancient promontory at Scarboro'.

Second, That the drift from Scarboro' has supplied and gradually deposited the main part if not the whole of the materials composing the more recent portions of the formation.

Third, That the drift is in consequence of the singular progressive action given to sand and gravel beaches under certain circumstances by the waves.

Fourth, That the harbour is daily being impaired by its chief agent of formation, and that its only entrance is threatened with early destruction by the same cause.

Fifth, That its preservation may be permanently effected by the construction of groynes at well selected points.

Sixth, That the dangers to be feared from the silt of the Don and sewage of the city although remote, would, taken in conjunction with the increasing deleterious effects of the latter on the water of the harbour warrant their total exclusion.

Seventh, That the construction of a south-eastern entrance would be a great accommodation to the shipping, may improve the purity of the Bay water, and, if properly executed, have no effect in lessening its depth; but would only assist in the preservation of the harbour so far as its piers, acting as groynes might retard the sand, widen the narrows, and thus strengthen the weak point of the Peninsula.

Although the preventive and remedial measures are founded on what I believe to be correct deductions, yet, seeing that they differ materially from those advanced by others who have considered the subject, they are presented on that account with some degree of timidity. I purpose, however, with the view of either confirming or modifying the conclusions arrived at, to continue a series of observations, carefully noting the various changes going on ; and will if deemed worthy, take much pleasure in laying the results of such observations before the Institute at a future time.

By the perusal of that paper, it will be found to be chiefly founded on a very laborious and expensive survey made between August, 1849, and the spring of 1850. Without such a survey, I am inclined to think any opinions on the subject would be too speculative to be of much practical value, and I may therefore claim that in this competition due consideration be given to my previous labors, of which this Report may be considered as the result.

All the leading characteristics of the peninsula were laid down by careful triangulations—the shoals lakeward by soundings and angular intersections, and the nature of the bed of the basin ascertained by boring and soundings through the ice, and chaining on its surface; these soundings amount to between two and three thousand, and are reduced to an approximate mean level of Lake Ontario, ascertained in conjunction with Captain Lefroy, from a series of lake levels taken by his directions during several years. The chart made from this survey is a necessary accompaniment of this Report, and I shall be happy to submit it any time for your inspection ; but since I have yet hopes of refunding myself (by its publication) for the cost of its production, you will be pleased for the present, therefore, to consider the copyright secured to me.

The results deduced from the evidence set forth in the paper referred to were so startling, that on the occasion when I had the honor of laying it before the Institute, I determined to lose no opportunities of verifying or contradicting them. The promise then made I have not failed to make good, having from time to time instrumentally observed the various natural changes in progress: and since those observations were made with the greatest care, and appear to be of considerable value, I am gratified by the opportunity now afforded me of laying them before you. Being led to believe that my views on this subject are at variance with the acknowledged opinions of parties officially connected with the harbour, I have been especially careful to review the grounds of my decisions, and have discovered no reason for departing from the opinions originally expressed by me in the paper referred to, but on the contrary have been strengthened in them by subsequent and very recent investigations. I therefore frankly submit to you my convictions, taking leave to remark, that they are based on well ascertained facts, capable of positive proof, and not at all on any of the many prevailing rumors and baseless suppositions which are current amongst us in relation to this harbor formation and its present state.

It may be laid down as an axiom that a right understanding of the causes of the formatiou of the Harbour and of the continual changes it is undergoing, is essential to the consideration of any preservative measures. The document attached enters so fully into this part of the question that it appears to me unnecessary to enlarge thereon, more especially since four years additional observation very materially strengthen and go far to confirm the opinions therein promulgated. I will first, then, explain the nature and results of the instrumental observations recently made.

My attentiou has lately been more particularly bestowed on the subaqueous operations at the Entrance, not that they are here most active, but because they are least conspicuous and most to be dreaded. To ensure accuracy the following steps were takeu :

The approximate mean level was referred to a permanent stone benchmark, the stone step of one of the cellar doors of the Custom House, under which it was found to be six feet and one inch. The meau being only approximate and subject to after corrections, six feet under this benchmark was assumed as a good datum, and to which all soundings were reduced. Scales were established at various points with zeros corresponding in level.

A floating chain 462 feet in length, made of long wooden rods linked together with iron rings, was constructed for measuring with the greatest possible accuracy horizontal distances on the surface of the water.

An iron tripod was erected on the shoal as a fixed point from whence to stretch the chain and measure distances.

A graduated standard sounding pole was used for measuring depths.

A self acting tide guage was constructed for the purpose of giving a continuous register of every fluctuation in level, and affording a means of arriving at the extent, nature, and precise number of fluctuations, of which so little is known, and on which phenomena so much value is placed by many as being the cause of currents in your Harbour. I regret to state, however, that I have as yet been unable to apply this instrument to its purpose, for being unrecognized and unassisted in this service, I could find no position in which to establish it, nor have my means justified me in incurring the necessary attendances for observation during my own absence from the city.

Thus provided (omitting the last mentioned instrument) I commenced my second survey on the 27th November, 1850, and was to a certain extent very successful, but during the night some evil-disposed person unknown, removed the iron tripod stationed on the shoal leaving, to my regret, the survey only partially finished, and thus vexatiously disheartened I had on after occasions to adopt other, though perhaps not much less accurate measures.

Two theodolites were placed at stations as far apart as possible on the Queen's Wharf, their distance being carefully measured, and the points where soundings were made ascertained by a proper code of signals and angular intersections. The soundings were in three cases likewise made by the standard rod, and all were carefully reduced to the same datum, the assumed approximate mean level.

In this manner surveys were again made on the 27th November, 1851, the 12th December, 1853, and the 25th April, 1854, each of which are delineated on the accompanying diagram. The soundings and contour lines of each survey are shown respectively in different columns as follows:—

The survey of the	27th November,	1850,	in *Red.*
"	27th "	1851,	" *Blue.*
"	12th December,	1853,	" *Black.*
"	20th April,	1854.	" *Yellow.*

An examination thereof will show very clearly the progressive advancement of the shoal northward, attributable to the same causes and formed in the same manner as already explained in the paper referred to. The diagram shows the minimum width of the channel between ten feet water lines to be as follows at the several dates:—

1st October, 1849,	108 yards.
27th November, 1850,	100 "
27th November, 1851,	90 "
12th December, 1853,	77 "
20th April, 1854,	73 "

As the north ten feet water line of the channel is 13 yards south of the Queen's Wharf, in taking the width of the entrance from the edge of the Wharf 13 yards must be added to each of the distances. Although these figures are not a fair criterion to judge of the rate of advancement of the shoal, seeing that the precise position of the annual deposit is not always in the line of the minimum width of channel; yet these and the diagram prove very positively the progressive encroachment, and show an average narrowing of the channel of about eight yards annually, thus establishing the truth of the deductions based upon my previous survey as stated in the accompanying paper and illustrated by a model of the entrance deposited in the museum of the Canadian Institute.

With these measurements taken with the utmost care, and with others similarly taken at the Isthmus, we are now in a position to answer in very positive terms those questions most particularly referred to in the notice you have issued.

These propositions are as follows: "The effects which have been produced, or are likely to be produced by the present breach at the eastern extremity of the Bay of Toronto, particularly with reference to the bar at the entrance to the Bay. If prejudicial to the Harbour, suggest the best means of closing it, and of strengthening that part of the Peninsula against further encroachments by the waters of the Lake."

First, then, the breach has had no appreciable effect on the bar, for during the period when it was open, the bar has been enlarged in precisely the same manner, through the same causes, and at a similar rate to that in which its formation proceeded when no breach existed.

Second. Reasoning by analogy from the above, the breach (if again opened) will not likely produce any appreciable effect, beneficial or otherwise on the bar.

Third. The effects produced on the harbor generally by the breach amount only to an unimportant change in the contour lines under 15 feet water in its immediate vicinity, and there only; which change, when viewed in relation to the harbor as a whole, cannot be considered of any moment whatever. Whilst however it has hitherto been prejudicial to an almost inappreciable extent, and although now completely closed by the westward progressive motion of the beach, it is undoubtedly subject to be opened again by the same causes which formerly produced it, viz.: the destructive action of storms point blank on the shore, and may, by a continuance thereof be dangerously enlarged. It is therefore desirable that a recurrence of this breach should be guarded against, and I proceed to submit how in my opinion this may be effected.

To strengthen this part of the Peninsula two methods present themselves: 1st. The construction of groynes. 2d. The construction of a canal or eastern entrance. Two properly constructed groynes, established on the lines marked in red on Plan No. 2, would effectually and permanently strengthen and protect this part of the peninsula by retarding the progressive motion of the beach, and thus arresting the moving sand and gravel, an accumulation would gradually be formed on the outer shore calculated to prevent further encroachments of the lake.

The construction of a Canal at the Isthmus is a proposition on which, along with the beach, there has been great diversity of opinion, as will be seen from the following extracts from reports on the subject recently published.

Mr. Shanley says, 28th January, 1853:—"The very great advantage to be derived from having an eastern entrance to the lake will probably keep this subject so constantly before the public, that the experiment will ere long be tried, more especially as the breach which has lately occurred would seem to have taken the initiative in the matter and 'pointed out the way.'

"The making of such a channel will be a simple matter of *cost*, and, once made, a short time will serve to show whether the advantages accruing from it will be sufficient to counterbalance the expense of maintaining it. I have termed it an experiment, and

such I believe it to be in the widest acceptation of the term—being doubtful that the problem of what its effects upon the harbor will be can be satisfactorily solved beforehand. It may prove immensely detrimental to the bay in drifting in vast quantities of silt and shingle; or it may simply fail to accomplish the end intended by working out its own destruction by silting up more rapidly than the dredge could free it. None I think will deny that one or other of these results is amongst the possible contingencies waiting on the experiment in question; and though I have not given the matter the attention necessary to enable me to pronounce confidently on the above points, I must record my opinion that the new channel would not be a self-sustaining one, and that its effect upon the present entrance would be the reverse of beneficial."

Mr. Kivas Tully says, 10th February, 1853:—"I would now direct attention to the eastern entrance, which has been lately formed, and which I venture to predict will not be closed again." And, further, he says: "The breach which has been made lately at that portion of the peninsula called the Narrows, about half a mile east of Privat's tavern, shews the practicability of constructing an eastern entrance, and it is not likely that this new channel will ever be filled up from natural causes. I examined this channel on the 8th inst. It is about fifty yards wide and three feet in depth, with a current of about two miles an hour running through it in a south-easterly direction. The wind blowing strong at the time from the S.S.W., the current was quite sufficient to keep the channel clear of the sand which was washing into the entrance with the return of the waves, which were pretty high at the time. At all times there will be a current through this channel, either into or out of the harbor. During the prevalence of an easterly gale the current will be inwards at the eastern and outwards at the western entrance; and during a westerly gale this action will be reversed, and the velocity of these currents will be sufficient to keep both entrances open."

Captain Richardson says, January, 1854:—"The boundaries of the harbor being of sand, unless known physical laws be suspended for the benefit of Toronto harbor, *a current through it will accelerate its ruin.*" "I will here simply state my opinion on the effect that a canal 200 feet wide and twelve feet deep at the Narrows would have upon the harbor: During a strong S. W. wind it would cause such a current over the bar and along the south side of it (judging from the effects as now seen at the breach) as not only to deluge the harbor with sand, but in a short time to sweep away block-house point and all the inequalities of the north side of the peninsula, and convert the harbor into a wide-mouthed bay, at the expense of the east end of it first. With the peninsula intact all gales are favorable to the channel and maintainance of the bar. During a breach in the peninsula all high winds are more or less destructive to the harbor." "The present breach by the lake at the Narrows is similar to the warning shock of an earthquake before volcanic eruption—it forbodes coming events—and an irruption of sand into the harbor, during some extraordinary gale, may be found as destructive to it as an irruption of lava to vineyards and villages."

I am inclined to agree with Mr. Shanley, in considering the effects of an eastern entrance somewhat problematical, whilst I am induced to believe that both the opinions above quoted are based on very insufficient grounds, as on the one hand the breach has been already closed without artificial aid, and on the other its effects have not fulfilled the predictions. As a proof also that by far too much stress has been placed on the effects of lake currents, the breach is now filled to such an extent with sand, that without a previous knowledge of its position one could hardly tell where it had existed.

That currents exist at the present entrance there is no doubt, and whether attributable to the wind or other natural causes, these currents are doubtless due to occasional differences of level between the waters in the bay and the open lake. If a particular wind exerts a force sufficient to elevate the lake in the vicinity of Toronto a certain number of inches, that rise must of necessity be communicated to the bay through the entrance, and hence a current of a certain velocity; and this operation would be reversed on the falling of the water in the lake by a change or fall of the wind. If, therefore, the harbor be provided with two entrances, and if we assume, for the sake of argument, that the sectional area of the second entrance be equal to the first, the current in this case will be equally divided, and its effects, whatever they may be, diminished one-half, and so in proportion to the relative sectional area of the entrances. Thus, then, the effects of currents at the western will be diminished in proportion to the width and depth of the proposed canal at the Isthmus.

We now arrive at the question: *What are those effects?* The undoubted tendency of currents in a channel such as the entrance to Toronto Harbour, is to increase its width and depth; it does not follow that currents in this case have no such tendency, because neither width nor depth have been increased, since they may have been exerted in counteracting other causes as powerful as themselves; but I think it will clearly follow that the currents have no effect, or at least no effect of real or practical value, if it can be shown that the channel has been narrowed in width nearly at an equal rate during equal or proportionate times; for it must be observed that the currents would necessarily increase in velocity, and hence in their scouring effects, the more the opening through which they passed was contracted. Since the end of last century up to 1849, the average rate of the encroachment of the shoal is shewn to have been from 7 to 10 yards per annum; since then, during 4½ years, it has advanced 35 yards, giving an average rate per annum of 8 yards; and during the last four months, it has advanced at the rate of nearly 12 yards per annum. Thus, then, while the width of the entrance has been diminished, the annual rate of the encroachment of the shoal has actually increased, and the deposit moreover has generally occurred at that point where the current (if it had any effect) would have been the most active. Hence no other conclusion can be come to, than, that there are *no undercurrents* in the channel, or if there are, they have proved to be of no practical value. The fear, therefore, of destroying or diminishing the effects of currents at the western entrance by the construction of a Canal at the isthmus may be entirely laid aside, seeing that there are none.

We have now to consider whether or not the proposed canal would be self-sustaining; and, in this respect, I am still of opinion that it would not. To place its outer entrance beyond the influence of the beach action, it would be requisite to extend the piers into deep water, as shewn on the plan; through course of time, the progressive action being totally arrested, an accumulation would gradually form, more especially on the eastern side of the canal until reaching the extremity of the piers, ultimately rounding

them to the detriment of the artificial channel; to prevent which contingency the formation of additional groynes from time to time would be necessary; the construction of which although not involving much outlay would always be chargeable to the revenue of the canal.

I accordingly conclude that in relation to the present Harbour entrance the construction of the canal would be neither beneficial nor detrimental, and that if the preservation of the Bay be alone desired that object can more cheaply and quite as effectually be attained by the much more economical expedient of the Groynes on the Lake beach. These Groynes would probably cost £750 or £1000, whilst the canal could not be constructed for less than £45,000, and inasmuch as the latter may not be considered an engineering necessity, it may be simply viewed in its commercial aspects. Whether the convenience be desirable for the eastern trade of the Port, and if desirable but not being actually necessary, whether the work would be remunerative. Upon this latter point I entertain strong doubts, yet it is sufficient for me in the performance of my present duty to express my opinions only on the engineering question, leaving the better qualified body whom I am addressing to determine that of the commercial convenience. There exists no engineering necessity for the canal and its construction would result in no advantage beyond that due to increased facility of communication between this Port and the eastern portions of Lake Ontario.

I now proceed to reply to the next question submitted, viz.: "The advisability, or otherwise of enlarging the opening between the Harbour and Ashbridge's Bay, or of making a permanent opening into the Lake from Ashbridge's Bay." In doing so I shall consider it first in regard to engineering, and secondly in reference to commercial purposes.

Ashbridge's Bay as commonly known comprises an area of about 800 acres, triangular in form with the apex eastward, half of which area may with sufficient accuracy for our present intention be taken as marsh land, the other moiety water of very various depths. It is divided from the Bay of Toronto by a narrow belting of sand and gravel beach, through which two channels have been formed by the waters of the Don delivered into the main bay. Lakeward it is protected and separated from the main Lake by a long narrow sand beach precisely similar in formation to the neck of the Peninsula, and through which the Lake storms make repeated breaches. To construct proper works of protection to a beach so exposed and so treacherous, and to excavate so large an area of marsh would be a work of such immense cost, as not to be justified except by the most stringent and positive necessity, and under the warranty of certain and indisputable advantages.

It has been argued that by increasing the body of water within the Bay of Toronto, *thus extended*, a strengthened scour at the entrances would result sufficient to ensure their maintenance through all time. I have already I trust satisfactorily proved that no scour results from the present currents which indeed are entirely superficial, and I think it is undeniable that those currents are mainly created by fluctuations in the Lake levels, traceable to variations in the wind and possibly to some more remote and unappreciable agencies. Now the maximum variation in the Bay water levels hitherto observed, even on extraordinary occasions during any 24 hours (and it is clear that to extend the time would be to diminish the effect) may be taken at five inches, and would give 800,000 cubic yards of water in the whole Bay due to the rise and effective for scour, but the discharge of this quantity as has been shewn has never retarded the formation of the bar. Excavate Ashbridge's Bay, combine it with the present Harbour, and we should obtain at times of similar variations of level 530,000 cubic yards of water additional, or an increase of 66 per cent. on the quantity of water now occasionally flowing through the channel. And this addition can only effect the duration of the current, not its velocity, since the vertical column of water is not increased thereby, and hence also the velocity is not. Moreover, I am inclined to think we have taken much too favorable a view of the question, in assuming a rise of five inches, I have done so in the absence of more correct knowledge regarding phenomena of which so little; indeed I may say nothing authentic of value is known (for this purpose the self-acting tide guage referred to was intended). Although in possession of daily and occasionally more frequent observations reduced to a common datum, the information conveyed thereby is quite insufficient on which to venture an assertion, yet from the evidence before me I doubt much if the daily fluctuations exceed one-fourth the amount above stated throughout the year. It is not reasonable in view of the utter insufficiency of the present currents to anticipate that this addition in duration only would yield an effective scour, and accordingly I conclude, that with such an object the combination of Ashbridge's with the Toronto Bay would be valueless.

Again, it has been suggested that by such a combination, together with an opening or canal to the extreme eastward, a constant current would be insured through the entire Bay, and thus the channel kept open by efficient scour. Such an opinion would seem to be based on erroneous observation. The currents still always due and identical with the variations of Lake levels, would still be superficial, and so long as those variations continue to be (and they always will be) unimportant in amount and gradual both in regard to volume and time—so long I believe will all efforts fail to secure an efficient scour.

I do not, therefore, think it necessary or expedient in an engineering view to effect this combination, or to unite these Bays even by the enlargement of the present channel. If the present breach of the Toronto Bay be such as to require protective works, how much more would they be necessary where the existing beach of Ashbridge's Bay is weak and treacherous, and extended in a tenfold degree. And, moreover, if a channel only were constructed imminent danger would result from the contact of so large an area of swamped land, unless the channel were in fact constructed throughout the length of the marsh as a canal. It might be expedient to direct the water of the Don permanently into Ashbridge's Bay, not indeed that the deposit from that river is so extensive as to be much feared, for the chart shows that the deposition is of slow growth and far less than is popularly imagined, but that as those waters are of no value to the main harbour and might be made an effective conduit for the sewage of the City, the diversion would with such an object be conducive to the health of the City whilst not in a degree detrimental to its harbour.

If then I am correct in asserting that no advantage would result in engineering point of view by the opening of Ashbridge's Bay, it only remains to be considered whether when regarded commercially it is a desirable work, and I confess that when contemplating the extent of the present Harbour, and the construction of the

Esplanade by which shipping accommodation may so largely be extended, I can discover no necessity by which to justify so costly and I fear so doubtful if not dangerous an experiment.

Having thus expressed my opinion on all the points submitted in your advertisement, I shall now take leave to direct your attention to another, and in my opinion, the most important of all the questions relating to the efficient preservation of this Harbour. Until a comparatively recent period the formation to which this Bay is due was entirely consistent with the most admirable provisions of Harbour capacity, shelter, anchorage, and the conveniences of navigation. Up to such a period (and it is demonstrated by the charts) Nature was engaged in work eminently useful, and in a manner most fortunate and unimpeachable; nor did our predecessors fail to discover how excellent a haven had been formed, as to its inducements may be traced the selection of the site for the city, just as surely as to its influence may be attributed the rapid growth and great prosperity of this metropolis. At that time, and it may be taken as A.D. 1800, Nature began to destroy that which she had herself so well completed, and recently by such palpable encroachments on the Entrance to the Bay as naturally to induce alarm lest its commercial value might be endangered.

I have already shewn how regularly and constantly this encroachment has been proceeding, how year after year the channel has been decreasing in width and the shoal extending, and I have endeavoured to trace the source and causes to which these dangerous accumulations are to be attributed, showing, I trust satisfactorily that the same agencies are engaged to this day in the same work of injury.

And yet it is strange that with the exception of the construction of the Queen's Wharf in 1835, and its extension in 1853, works in my opinion entirely inconsistent with, and as the event has proved entirely inadequate to the object sought, no effort has been directed to the preservation of the present Harbour channel, but public attention has been attracted by speculative and ambitious attempts to alter where alteration is unnecessary and dangerous, and to improve that which Nature has left perfect to our hands; neglecting meanwhile the one and only point in which her operations may be regretted and where interference is justified by danger. It is to this point that I shall now address myself, convinced that if this be neglected works at no other place can compensate for the omission or preserve the Harbour in an efficient state.

In the Harbour Master's Report of January last, he says, "Upon the faith of the current (to which in a preceeding paragraph he declares that the Harbour owes its navigation) the extension of the Queen's Wharf was advised, and although it is as yet only constructed half its length, a widening in the channel has already taken place." I have already proved (by demonstration of actual measurement) that the currents here are too feeble to be of any service in retarding or removing the deposit, and the declaration of the Harbour Master appears to be inconsistent with the facts. This is scarcely extraordinary, for unless the measurements be made with the greatest delicacy and reduced to a well-established datum, it is difficult, nay impossible, (owing to the frequent variations in level), to arrive at accuracy.

From recent measurements made by me in continuance of the whole system of survey upon which the charts have been laid down, it appears indisputable that since the extension of the Queen's Wharf was brought to its present state, and in the space of 128 days the ten feet water line of the shoal has been projected fifteen feet, the eight feet line twelve feet, and the six feet line twenty-five feet into the channel northerly, thus diminishing its widths by those amounts. It is accordingly apparent that the Queen's Wharf works, recent as well as remote, although fortuitously now of eminent advantage in a commercial point of view, have failed in the engineering service for which they were advised; and they have failed because they have *not* resulted in strengthening the current and creating a scour as was anticipated, because in truth the current which has ever been inoperative in checking the shoal formation is so still, being now as always superficial.

In the paper to which I have so frequently referred I have demonstrated the manner in which this encroachment is proceeding, and it is sufficient here to repeat that it is brought from the southward, and that every effort to check it by the current has been ineffectual. We may, therefore, reasonably abandon such an expedient, which, however excellent and efficient it may be found in tidal waters, should not, therefore, induce us to rely upon its adequacy when attempted under such totally different circumstances.

To preserve the Entrance from further encroachments of the shoal and to arrest the beach drift at a convenient and safe distance therefrom I would recommend the early construction of the following works:—

Ist. A groyne at the Lighthouse Point to retard the sand now moving northerly, and divert it into deep water westerly.

2nd. An auxilliary groyne opposite Gibraltar Point, to arrest and counteract all progressive action along the west side of the shoal, thus enabling all drift to accumulate south of the clear water opening of the Bay and preserving the present extended passages to facilitate the early removal of ice in spring.

3rd. A Pier along the south edge of the channel as shewn on the plan of a total length of 290 yards, cutting off about 350 feet from the point of the shoal to a depth of twelve or fourteen feet by dredging, thus enlarging and permanently deepening the navigable entrance from 240 as now to 600 feet as proposed. With such work properly constructed, I am confident in the opinion that the difficulties hitherto connected with the western channel would be removed, and that the Entrance to the Bay would be permanently preserved in an efficient condition. The Harbour would then be such as for extent and convenience, would I believe be altogether sufficient and satisfactory, And I take leave very respectfully to repeat my conviction that it is more consistent with prudence to content ourselves by checking an ascertained evil, by simple, palpable, and safe expedients, than to rush wildly into costly experiments having no actual bearing on, and at a distance from, the only evil by which we are embarrassed in the frail hope of begetting an advantage of uncertain value.

The following is an approximate estimate of the several works proposed:—

Ist. A groyne at Lighthouse Point, 450 feet in length	£900	0	0
2nd. A groyne near Gibraltar Point, 800 feet in length	600	0	0
3rd. A Pier at the entrance, estimated 14 feet under water, and 55,000 cubic yards dredging	10,200	0	0
4th. Two groynes at the Isthmus	850	0	0
	£12,550	0	0

It will be observed that a large item in the above estimate is involved by the proposed enlargement of the present entrance to a full width of 600 feet of deep water; that although 400 feet might suffice and reduce the first cost about three thousand pounds, yet the increased and permanent advantages resulting from the enlarged entrance, would I am inclined to think warrant the additional expenditure. Since you do not at present require detailed plans and estimates of the proposed works, I have deemed it unnecessary to prepare them. I may, however, again refer to the fact that I have in my possession charts and other documents bearing upon the question before you, and although they are the bases upon which the opinions now submitted have been formed, as they have been prepared at great labour and expense, and are of some value to me, I have refrained from attaching them to this Report.

If, however, you should desire to examine them, I shall be most happy to attend at any appointed time, and submit them to your inspection.

I have the honour to be, Sir,
Your obedient servant,
SANDFORD FLEMING.

Toronto, May 4, 1854.

REPORT

ON THE MEANS TO BE ADOPTED FOR THE PRESERVATION AND IMPROVEMENT OF THE HARBOUR OF TORONTO,

BY KIVAS TULLY, ESQUIRE, PROVINCIAL SURVEYOR.

[*The Third Premium of Fifty Pounds was awarded to the author of this Report.*]

The opinions of the several professional and scientific persons who have previously written on this subject, are so widely different, that, to discuss each separately, would far exceed the limits of a report of this description, and which, for all practical purposes, cannot be considered necessary. The present intention, therefore, is to condense the subject as much as possible, consistent with a due explanation of the means to be recommended, founded on the most reliable data.

It is proposed to divide the report into two heads, one on the Preservation, the other on the Improvement of the Harbour; the expense necessary for preserving the Harbour, as it will be shown, being far less than that which may be required for its improvement.

Previous to entering on the discussion of the subject, it is necessary to remark, that the construction and extension of the Queen's Wharf was the most advisable course that could be followed heretofore, both for the preservation as well as the improvement of the Harbour, and must be a source of much satisfaction to those who recommended its construction originally, and were afterwards instrumental in carrying the project out—to think that, up to the present time, there has been no useless expenditure, a result that cannot always be avoided even by the most experienced persons.

1st. The preservation of the Harbour.

In order to form a correct opinion, it is necessary to inquire into the causes of the original formation and increase of the Peninsula, forming its southern boundary.

Sir Richard Bonnycastle, in his report in 1834, in reference to this subject, states—

"The Peninsula, opposite the southern face of the city of Toronto, appears to me *a much more ancient formation than is generally imagined*; it is composed of sand in various states of cohesion, the surface being usually disintegrated, and increasing only in firmness and tenacity as it increases in depth. It is probably one of the many ridges of the bottom of the vast Lake, which existed before the present Ontario and Erie were formed out of its drainage, nor has the shape of the Peninsula materially altered for a vast length of time.

"The French entered the basin, and fancied it a river, when they first explored the country under the guidance of Hennipen, and the oldest surveys show little or no difference in its outline.

"It is not necessary, however, with the object at present in view, to enter into a geological description, to prove that the Peninsula was made during the sedimentary deposition of the tertiary periods; but it is useful to that purpose to ascertain that it is not comparatively new, or in the constant habit of receiving great accessories to its bulk and extension."

These opinions, written twenty years ago, besides being corroborated by later authorities, have been proved to be correct by recent examination.

A superior set of boring irons were constructed for the purpose of ascertaining the substratum of the Peninsula, and in order to set the question for ever at rest.

The first and second trials were made at Gibraltar Point, and the same result was obtained in both instances, namely, sand and gravel in alternate layers, three feet in depth from the surface of the water, and finding, after considerable labour, with four persons working the boring irons, that no greater depth than three feet could be obtained, a specimen of the substratum was procured with the shell augur, and found to be blue clay, or hard pan, as it is more commonly called.

The resistance of the sand and gravel on the third trial, at the Narrows, east of Privat's tavern, was found to be so great, after boring about two feet, that a lighter boring iron was procured, with

one end hollowed out to receive the substratum, and after several trials between Gibraltar Point and the Narrows, along the centre of the Peninsula, the same result was obtained. Specimens of the clay and a memorandum of their respective positions and depths are herewith submitted for inspection. The hollow in the iron being of small capacity, a small portion of the clay could only be procured, and even this is mixed with the fine sand which lies on the surface of the clay.

There is, however, sufficient evidence of clay in the several specimens to prove the assertion, that the base of the Peninsula is coeval with that of the mainland, and not a deposit caused by the action of the waters of Lake Ontario.

It is intended to pursue the investigation still further, and, in all probability, the same result will be found on boring east of the Narrows, towards the heights of Scarboro', and also on the neck of land that separates the Harbour from Ashbridge's Bay.

Whether a portion of the sand and gravel resting on the substratum of the Peninsula was an original formation or not, it would be difficult to ascertain ; but the most likely conclusion would be, that it has been deposited on the ridge forming the base of the Peninsula since the period when the water which covered the greater portion of the North American continent subsided to its present level.

The sources from which this deposit is and has been supplied, is explained in a letter of mine, dated Febauary 10th, 1853, as follows :—" The continued accumulation of deposit on the Peninsula, are the washing away of the shores of the Lake to the east and west of Toronto. During an easterly gale, which generally lasts three days, the 'debris' from the Scarboro' heights is washed along the shore of the Peninsula to the lee of the Lighthouse Point, and during westerly gales, which generally succeed easterly ones, the 'debris' from the shores west of Toronto, as far as the point of the Humber Bay, is washed along the shore towatds the Peninsula, and meeting the current of the Don at the western entrance, is deposited on the Bar."

A comparison between the deposit on the Peninsula and the formation of the Scarboro' heights will prove, that not one-twentieth part of the "debris" finds its way to the Peninsula.

The formation of the Scarboro' heights being principally argillaceous, and the deposit on the Peninsula being granitic detritus, the argillaceous portion of the debris being the lightest is carried to a much greater distance, and sometimes three or four miles out into the Lake by the underton, where it is deposited when the causes that originally removed it cease.

Pursuing this question still further, it will be found on examination that a considerable portion of the "debris" travels eastward as well as westward, the prevailing winds being westerly, though the easterly winds are the most violent. The effect produced by the prevailing westerly winds in Lake Erie is evideuced by the more extended deposit forming Long Point, and also the Harbour of Erie.

The above remarks, though more diffuse than may be considered requisite, are introduced to prove that the whole of the "debris" from the Scarboro' heights is not deposited on the Peninsula, and the same may be said of the deposits from the river Don.

That the construction of the Queen's Wharf has had the effect of changing the line of deposit on the Bar, cannot be for one moment doubted.

By referring to the map published by Mr. Bouchette in 1815, it will be observed that the point of the bar was more easterly than it is at the present time, and to the increased back current out of the Harbour, caused by the contraction of the channel, may principally be attributed this result.

Assuming the above remarks to be admitted facts, as such, they cannot be controverted by mere conjectures—some of which are calculated to remind a person of the reply of a celebrated member of the British Parliament to the speech of a consequential representative from one of the inland counties, who felt flattered at being noticed by him—" There is a great deal in the hon. member's speech that is new and true, but, unfortunately, what is true is not new, and what is new is not true ;" and with these remarks he went on with the subject under debate.

Whatever may have been the result of the action of the current of the river Don on the formation of the Peninsula, it has not much influence at the present time—the current being very trifling at ordinary times.

During floods, the injury to the Harbour by the deposits of alluvial matter suspended in its waters are very considerable, though, fortunately, the direction of the flood, when the Don overflows its banks, is into Ashbridge's Bay, where the greatest amount of deposit is made. A large portion, however, reaches the Harbour, and the lighter particles are even carried out some miles into the Lake before they are deposited. During the prevalence of a flood in the Niagara river, about five years ago, caused by continued wet weather, when the ice was breaking up in Lake Erie, the water at the mouth of the river for five miles, at least from the shore, and an equal distance on either side, was quite discoloured, and the neutral liue between the Lake and the river waters was quite distinct.

If the foregoing remarks are correct, and there can be no reason to doubt them, it must be admitted that the injury to the Harbour, in consequence of this deposit, is greater than the benefit to be derived from its current. As one of the precautions necessary for the preservation of the Harbour, it is advisable to alter the direction of the current into Ashbridge's Bay, and allow it to find a passage into the Lake through the eastern entrance in Ashbridge's Bay, and if at auy future period a canal should be made, connecting Ashbridge's Bay and the Harbour, the entrance into the Harbour should be protected by gates, so as to prevent the current from the east bringing with it the mud that has been deposited in the marsh for ages past, the mud in Ashbridge's Bay being at least twenty feet higher than the bottom of the Harbour.

Fortunately, the present connection between tho Bay and the Harbour is very slight, and, according to the annexed estimate, a comparatively small amount would be necessary to close up the mouths of the Don, and alter the direction of the curreut into Ashbridge's Bay.

The deposits from the sewers of the city in the Harbour, is much more considerable than would at first be supposed ; from experience in the coustruction of wharves, piling, &c., it has beeu found that, from Yonge Street on the west to the Don on the east, the average depth of deposit from the sewers alone is not less than two feet, taking the distance to be 5000 feet, with an average breadth of at least 300 feet we have a quantity equal to about 100,000 cubic yards, a very serious amount, considering that it only extends over a period of say twenty years ; the annual deposit will

of course increase in proportion to the population, so that at the end of twenty years more, taking the population at that time to be 100,000, the increase of deposit may be fairly calculated to be at least 700,000 cubic yards in addition.

In Sir R. Bonnycastle's Report, this subject is also briefly alluded to, as follows, and the injury to the Harbour anticipated: "I also beg to remark that in making the sewers for this City, it would be very advisable to construct one main sewer through the whole length down to the Marsh, instead of lateral ones into the Bay."

The difficulty of constructing a main sewer in an easterly direction is insurmountable, in consequence of the want of a sufficient fall, a sewer constructed as above described being almost on a level, would be always subject to be choked up with the deposits from the lateral drains, and from this inevitable result would be destroyed in a few years.

In a letter of mine addressed to the City Council in 1853 it is recommended "that a covered channel should be constructed in the centre and beneath the intended Esplanade, from the River Don to Queen's Wharf.

The drains of the City to be extended to this channel, and a portion of the current of River Don to be turned into it by damming the present channel and allowing the surplus water to flow into the Marsh as at present over a waste weir one foot in height above the present level of the water." This would be self-acting, and would carry off the unhealthy deposits which are now being made in the Harbour, as evidenced by the rank vegetable growth in the stagnant water about the wharves.

As the final disposition of this matter rests with the City Council it may be considered sufficient for the present purpose to state, that for the preservation of the Harbour the sewers should not be permitted any longer to empty their filth into it, which if otherwise provided for, instead of being an injury to the Harbour and a cause of unhealthiness to the citizens, would eventually be a source of profit.

For the preservation of the Harbour the next question that suggests itself is the strengthening, or the opening, of that portion of the Peninsula termed the Narrows; when the question of the improvement of the Harbour is taken up, it will be sufficient then to show the advantage to be derived from the construction of an eastern entrance, or the contrary; but as far as regards the preservation of the Harbour is concerned there can be no doubt that the strengthening and not the opening of this portion of the Bay is the safest and the most advisable plan.

Considerable damage has already been done by allowing the breach at the Narrows to remain open so long as it had been, as some thousands of cubic yards of sand have been washed into the Harbour during the high water and the action of easterly gales.

Very little damage can be done to the Harbour at present at this point, as the prevalence of westerly gales in the autumn of last year, and the formidable barrier of ice that protected it during the winter, collected a considerable deposit on the Lake side, and since that time, the water having fallen about 15 inches, has increased the width of this portion of the Peninsula considerably, but from its position being a curve from the regular line of the beach, it will always be subject to damage during high water, as the whole force of the waves produced by an easterly storm breaks on it and carries the lighter particles of sand into the Harbour.

To strengthen it and encourage the accumulation of sand at this point two rows of piles, 20 feet apart, and five feet above the surface should be driven on the inner or Harbour side from the Marsh to Privat's Tavern, the piles to be lined with plank on the inside, and the space filled up with the deposit from the Marsh, which is convenient, the base of a substantial bank will thus be formed, which can still further be strengthened by planting, &c.; the action of both wind and water on the sand will be to form a slope on the Lake side, which will most effectually secure this portion of the Peninsula from further encroachment. The cost of the above is also stated in the annexed estimate.

The construction and extension of the Queen's Wharf having determined the result at the western entrance as before stated. The old adage of "let well enough alone" may be safely applied in this instance.

If 100 feet is dredged from the point of the bar, so as to widen the channel to 400 feet, to enable sailing vessels to beat into the Harbour during easterly winds, as they were in the habit of doing until the present, and the wharf extended westerly in a line with the point of the bar, which work is now under contract, and will be completed this year; the bar cannot possibly close up the channel as the current into and out of the Harbour will always be sufficient to keep the channel clear; the opinion which was expressed in my letter of 1853, experience has proved to be correct, as the extension of the Queen's Wharf 200 feet since that time has produced the very result which was then anticipated.

It is there stated "as to the extension of the Queen's Wharf westward it cannot effect the channel, provided the deposit on the bar is removed as recommended, it would not increase the deposit, it would merely alter its form, which would then assume a westerly direction."

In order to understand the subject thoroughly it will be necessary to investigate the effects of the current into and out of the Harbour during the prevalence of easterly as well as westerly gales. As to the fluctuations of the water on the Lake during calm weather they are so irregular in their action that the result is inappreciable though certainly beneficial.

During a westerly gale the water rising suddenly in the Lake by the action of the wind the surface level will of course be maintained, and the water will flow into the Harbour. The effect of the force of the wind on the surface level of the water, causing it to rise at the opposite point from which the wind may be blowing at the time was ascertained by Smeaton to be eight inches in one mile, the wind blowing a strong gale, or at the rate of 40 miles per hour at the time. The experiment having been made on the water in a narrow canal, is hardly any criterion of the effects that a gale of wind of the same velocity might have on so large an expanse of water as Lake Ontario; but still it will afford some data to be enabled to judge of its effects by comparison.

The great damage caused occasionally at the Harbour of Buffalo, and other ports on Lake Erie, by the sudden rise of water, caused by severe westerly gales in that comparatively shallow Lake, is also a further proof of the force that is produced by the action of the wind on a large surface of water, the actual effect can only be ascertained by continued observation. The records kept during the last few years by the Harbour Master prove the sudden rise of the water from the effect of an easterly as well as a westerly gale to be from four to six inches, and even more.

The above remarks refer to the first effect; for the flow of water into the Bay through the western entrance the reaction has also to be considered, and according to the laws of motion, which are applicable to fluids as well as solids, the action and reaction are equal; the action is constant in its effects when the water in the Harbour is raised to the same levels as the water in the Lake a reaction takes place and two currents are established one into and the other out of the Harbour; and those currents are much increased by the surf on the bar, which acting as a sunken breakwater, the surface water is forced into the Harbour by its momentum and returns by the deep channel near the wharf. To the effect of this current may be attributed the steep edge on the inside of the bar, and it has also been found efficacious in scouring the channel.

The effect produced by an easterly gale is the same, with the exception that as the waves do not break with such great violence on the bar, the additional effect from this cause is lost.

The difference of level caused by an easterly gale is greater than that produced by a westerly one, as it acts on a larger surface of water.

As an easterly gale increases the deposit on the bar on the Lake side more than a westerly one, it is evident that a westerly gale is more beneficial in its effects on the maintenance of the channel.

From the above remarks the conclusion may fairly be drawn that a channel which has been maintained by natural causes for years past may be injured by an interference with those causes which the construction of a pier on the point of the bar parallel to the Queen's Wharf would most decidedly produce.

The recapitulation of the several recommendations for the preservation of the Harbour will therefore be as follows:—

1st. The closing of the Don, and diverting the current into Ashbridge's Bay.

2nd. Tho sewage of the City to be prevented from being emptied into the Harbour.

3rd. The strengthening of the Narrows of the Peninsula.

4th. The continued extension of the Queen's Wharf, so as to be always on a line with the point of the bar.

That the Harbour can be preserved for ages by the course above recommended I have not the least doubt, and should such a contingency ever arise as the removal of the deposit on the base of the Peninsula by any future action of the waters of the Lake, which is extremely doubtful, the recent examinations by boring provo that the substratum is sufficient to bear a stone facing on tho Lake side, similar to the one constructed in front of the New Garrison, which has stood the test of six years' experience without any injurious effect, and to resist the action of the waters of the Lake for an indefinite period, so that as far as the decay of the Peninsula is concerned it is altogether mythical, and reduces the question to one of expense.

THE IMPROVEMENT OF THE HARBOUR.

With respect to the improvement of the Harbour it is intended to treat this question altogether as a separate matter.

The only alterations from the preceding remarks on the Preservation of the Harbour would be instead of strengthening the Peninsula at the Narrows the opening is recommended.

The disposition of the River Don, the sewage of the City, and the maintenance of the western channel would remain the same; the question, thetefore, to be considered will be, the practicability of constructing an eastern entrance, its maintenance, and the effect produced on the western entrance in consequence of its construction.

The engineering difficulties to be encountered in the construction of an eastern entrance will be considerable and attended with much greater expense than at first would be imagined.

The base of the Peninsula having been ascertained to be of blue clay or hard pan, as it is commonly called, and being five feet from the present surface of the water at this point, the difficulties are rather increased than diminished, though the work when completed would be more substantial than if it was altogether sand.

The only way in which the blue clay or hard pan can be excavated to a depth, so as to afford 12 feet at low water, would be by the construction of coffer dams instead of dredging, which could be resorted to if sand and gravel alone had to be excavated.

The foundation of the piers would, however, be more secure and less liable to injury from the effects of the heavy sea that will have to be encountered than if sand and gravel formed the foundation.

Accompanying this Report is a map copied from one in the possession of the City Council which explains the position and capacity of the proposed eastern entrance.

In order to prevent the "debris" from the Scarborough Heights from being conveyed into the Harbour by the current which will be caused by an easterly gale, it would be necessary to run the piers into 20 feet of water at least, or to the line where the waves break, which indicates the state of the under current; to carry this out successfully will require the piers on either side to average 3000 feet each; the easteru pier to project 500 feet farther than the other, so as to afford sufficient shelter to vessels during moderate gales in running into the Harbour.

For reasons that will hereafter be evident it would not be advisable to make the entrance wider than 200 feet.

The piers would require at least to be 40 feet wide, and loaded with stoue iu the same manner as the exteusion now in course of construction at the Queeu's Wharf.

By constructing the piers as proposed it is considered they will be sufficiently strong to resist the effect of the most severe easterly storms, and the piers being run out into 20 feet of water, beyond the extent of the under current, no substance further than the lighter particles of argillaceous matter, which are held in suspeusion by the agitated water, can enter the Harbour; and in case of a current being established through the Harbour, which would occur in an easterly storm, this suspended matter would not be deposited in the Harbour, but would be carried with the current through the western channel into the Lake again, and *vice versa* in case of westerly gales, in fact it would not be more injurious than at the present time.

If this is correct the maintenance of the eastern channel canuot be questioned, the effect that would be produced on the western channel requires more serious consideration from the fact, that the back current at the western channel would be lessened in the exact proportion as the current through the eastern, and this remark applies whether an easterly or westerly gale prevails.

The data to decide the questions are as follows:—

The sectional area of the western channel, including the water on the bar, is in superficial feet 21,350

The sectional area of the eastern channel, 200 feet wide by 12 feet in depth, would be	2,400
Still leaving a surplus in favour of the western channel of	18,950

By reducing these amounts to the lowest fraction, the proportion of the sectional area of the eastern channels to that of the western, would be, as nearly as possible, one-ninth.

From the above calculations, it may be inferred that, during an easterly or westerly gale, there would still be a current flowing out of the Harbour at the western channel. In an easterly gale, there would be a current from the east to west through the eastern entrance, and *vice versa,* in either case the current into, or out of, the Harbour, through the western channel, would be diminished one-ninth, and the consequent scouring effect on the western channel would be lost in this proportion. Whether this would have the effect of destroying the balance which has been maintained for so long a period, is a matter of opinion.

Supposing that the point of the bar advanced eight feet per year across the channel, which, however, it does not, the encroachment would be nine feet instead of eight feet. When the present contract for the extension of the Wharf westward 400 feet is completed, I am of opinion that the back current will be sufficient to scour the increased channel 400 feet wide, even in the event of an eastern entrance being constructed.

The current through the western channel, caused by the displacement of the water by steamers passing at full speed, is very considerable for the time it lasts, and has a good scouring effect, tending to prevent the encroachment of the Bar on the channel. If an eastern entrance is constructed, a portion of this effect will, of course, be lost, the proportion in this instance it would be difficult to ascertain. I do not, however, think that the loss would be so great in any case, as to endanger the filling up of the western entrance.

With regard to the arrest of the deposit on the bar, by the construction of piers or groins along the shores of the Peninsula, it can only be considered as temporary; and to be effectual, would have to be renewed and kept in repair year by year, an expense which will be found as much, if not greater than using the dredge.

In Sir Charles Lyell's Principles of Geology, page 318, speaking of the encroachments on the south coast of England, it is stated—

"It appears, from the observations of Mr. Palmer and others, that if a pier or groin be erected anywhere on our southern or south-eastern coast, to stop the progress of the beach, a heap of shingles soon collects on the western side of such artificial barriers. The pebbles continue to accumulate till they rise as high as the pier or groin, *after which they pour over in great numbers during heavy gales.*"

According to the old saying, "prevention is better than cure," if the true remedy requires to be pointed out; and admitting that the continued deposit on the Peninsula is caused by the "debris" from the Scarboro' heights, expend the money that would be wasted in the construction of piers or groins, in the protection of the base of the Scarboro' heights, and the object is attained; but the wisdom of this course is to be doubted; the deposit from this source is not so great as is imagined, and it must be borne in mind, that a considerable portion of the deposit on the Peninsula is removed by the under-current not to be replaced, except by this very supply from the Scarboro' heights, which is considered so great a nuisance—taking all matters into consideration, this supply, on the contrary, will, on reflection, be considered advantageous in preserving the Peninsula, and consequently preserving the Harbour. As to "making a permanent opening into the Lake from Ashbridge's Bay," it is a question that can be well postponed, as the present opening is quite sufficient for the requirements of that portion of the Harbour; and in all future speculations on the subject, it would be advisable to view it as likely to form a separate Harbour altogether from the present one; as such, with an entrance into Toronto Harbour duly protected with gates, to keep the mud which has collected there for ages from destroying Toronto Harbour, an excellent Harbour may be constructed by running out piers into deep water, as recommended for the eastern entrance of Toronto Harbour; the cost of such work is stated in the general estimate; though the expense is not advisable, as all available funds will be found little enough for preserving and maintaining a Harbour, which, up to the present time, stands unrivalled on the great Lakes of this Continent.

KIVAS TULLY,
Civil Engineer.

Toronto, May 3d, 1854.

ESTIMATES.

For the Preservation of the Harbour.

1st. Closing the River Don, and diverting the current into Ashbridge's Bay	£7,500	0	0
2d. The strengthening of the Narrows of the Peninsula	2,500	0	0
	£10,000	0	0

For the Improvement of the Harbour.

1st. Closing the River Don	£7,500	0	0
2d. Constructing the eastern entrance 200 feet wide and 12 feet in depth, piers 40 feet wide, running into 20 feet of water	60,000	0	0
	£67,500	0	0

Improving Ashbridge's Bay.

1st. Constructing channel in eastern end of Ashbridge's Bay, with piers, &c	£50,000	0	0
2d. Constructing canal, with gates, &c., 60 feet wide, 10 feet of water, where shown on the Map	10,000	0	0
	£60,000	0	0

KIVAS TULLY,
Civil Engineer.

Toronto, May 3d, 1854.

REPORT

ON THE PRESERVATION AND IMPROVEMENT OF

TORONTO HARBOUR,

BY HUGH RICHARDSON, ESQUIRE, HARBOUR MASTER, TORONTO.

[*A Supplementary Premium of Seventy-Five Pounds was awarded to the author of this Report.—See Extract from the Minutes of the Harbour Commissioners on page* 38.]

To the Commissioners of Toronto Harbour:—

Gentlemen,—Not with any pretention to engineering, not with the presumption of competing with scientific men, in plans, and estimates of plans, for the improvement of the Harbour: but, if I have understood the advertisement right, it admits the opinions of observers and of practical men, as well nautical as scientific, to compete in a sort of essay on the subjects embraced therein, which may lead to some beneficial decision, or induce more scientific aid.

If projects are in agitation, which, if carried into effect, I think would be destructive to the Harbour, nautically of little value, and commercially onerous, I, as a nautical man, a practical man, and an attentive observer of the Harbour of long standing, am entitled to intrude an opinion, and compete in the race of competitors, the labours of whom tend to the public benefit.

In my Report to the Commissioners of Toronto Harbour last year, I stated as my opinion that the breach then open was injurious to the Harbour, and urged the necessity of closing it, and so simple and trifling was the injury then, that the beach that was made on the 13th and 14th January last, closed by the operation of Nature on the 17th February following, and had the Harbour belonged to myself (with the opinion I held of its injurious tendency), I should then have raised the beach with the material around me to a height above the reach of the wave. If the aspect of the breach now is in any way formidable, the delay in closing it must be attributed to the public divided opinion, as to its beneficial or prejudicial effect upon the Harbour. But the mass of material that has been removed from the beach, essentially altering its feature, and the drift that has been brought into the Harbour, to say nothing of the undetermined effect it has had upon the Bar must convince the most sceptical of its injurious effect; and an examination of the shallow shelving coast is sufficient to preclude the idea of a natural channel ever forming there, if such an idea was ever entertained.

Further neglect may bring this Harbour into the perilous and costly condition of Erie Harbour at this time, to which it has a close resemblance, where, from having allowed it to become a presqu'isle by a breach at the West, it is continually inundated with sand, and threatened with destruction.

The means of closing the breach when no more formidable than when I observed it last fall appear to me very simple. It can hardly have escaped the notice of the observer that whenever the height of the Peninsula was above the reach of the wave, the wave was rolled back from whence it came harmless to the beach; and that it was only where the wave surmounted the apex of it that it became injurious in its descent on the opposite side.

To repair the breach in its then form with a current through it, it required first to stop the current, which might be done with as many rough plank of 2 inches, made into cases 6 feet long by 2 feet 6 inches × 2 feet 6 inches, filled with the material of the beach, as would stretch across the narrow neck of the breach in double row, ten or twelve feet apart, and filled in between, this would effectually stop the current, (the narrow part being only sixty feet wide and far removed from the beat of the wave), the current once stopped the process of raising the beach is the mere affair of carts and wheelbarrows, with labour and a plentiful supply of the material of the Peninsula. The object of these casoons being only to stop the current, which done all would be buried up. With moderate winds at S.W. and N.E., the lip of the wave would repair the beach in a fair line to a certain height almost as soon as the most active labour would raise the other part to the required height. More scientific and a more expensive process might be adopted, but none more efficient.

On examining the beach I observed the wave had never reached a height above five feet, where that height was twenty feet from the line of calm water, and treating the Lake for all immediate practical purpose as at a constant level, I had only to consider the casuality of an easterly storm; then looking round me for even the lowest part of the Peninsula that withstood that storm, I placed in imagination in the interval of the storm a section of it in the breach, and I felt myself secure, convinced that nothing could be so effectual in repairing the breach as the material of which it was composed.

The Lake was, when I observed it last fall for the purpose of estimating the height of beach required to resist the sudden encroachment of the Lake, two feet lower than the highest level, and two feet higher than the lowest; I therefore concluded that a beach six or seven feet above the highest water at 20 feet from the line of calm water, and a hundred feet wide in all, would be amply sufficient to secure the Harbour against further inroad from the Lake. I do not think that for many years the beach in that part has been five feet high. Be it remarked that the water being shoal without, the wave in any storm is greatly reduced in height and force in passing over the shoal water before it reaches the beach.

If cribs are made use of to stop the breach, the retrocession of the Peninsula (as I shall show) will in the course of time lay them bare, and even if they extended all the way to the head of Ash bridge's Bay, yet in time the whole line would be taken in reverse. Keeping the beach at all times and in all parts above the reach of the solid water of the wave, the retrocession will proceed safely, uniformly, and almost imperceptibly, but proceed it will, as it has done, and still does; breaches accelerate this, as witness the present effect, and examine the marks all the way from the fishing houses below the cross beach to some hundred yards West of Privat's Hotel.

But until the important question of a canal at the East end of the Bay is settled, I fear even the preservation of the Harbour will be a secondary consideration, I shall therefore publicly treat this question fully in all its bearings upon public interests, that is physically, nautically, and commercially.

Physically.—The superstructure of the Peninsula, the southern boundary of the Port is composed of drift—that is, clean washed sand and stones; the base of it I believe of all the material of the cliffs of Scarboro', the substratum most probably of indurated clay. The bar or western boundary of sand and clay.

I shall not enter upon the theory of its original formation, it is sufficient for my present purpose to assume what a quarter of a century's observation bears me out in, that all the drift comes from the East, mainly the debris from the high lands of Scarboro', that the Peninsula is the crest of a large shoal, that its maintenance above water is essential to the preservation of Toronto Harbour.

This drift is always more or less in motion by the lateral actions of the waves of the N.E. and S.W. winds.

Whilst the N.E. wind supplies the Peninsula with drift, it also by the violent action of its stormy wave erodes the beach and carries the produce gradually West. The S.W. wind more constant, but its waves less violent, brings back by a more gradual process much of this drift and mainly repairs the damage done by the former wind. But for this counteraction the Peninsula would erode and be extended more rapidly West. Were the tides always one way erosion would be constant on one side of an island, and accumulation on the other.

At right angles to this moving beach it is proposed to project out into deep water some eighteen hundred feet or more piers for the purpose of a navigable canal, intercepting the motion of drift both from the East and from the West.

The effect of these piers would be to cut off the supply of drift from the N.E., and bring it down from the S.W., filling in the angles until it ultimately made a passage round them. But so extended would these be, and so considerable the body of water to be filled in, that bays would form both East and West, giving greater force to the wave to act upon any attenuated part of the Peninsula; and it is more than probable that a very serious breach would be made in it East of the piers. The West end of the Peninsula no longer supplied would assume another shape, bearing down from West to East, and wasting away at the West.

This is the effect to be expected, presuming the piers built upon a sandy foundation and broadside on to the N.E. sea, which is heavier here than at any other part of the Lake, withstood its repeated concussions. It is common to allude to the piers of the Burlington Canal, to support an argument in favor of the facility of erecting piers for the Canal in question. The piers of the Burlington Canal are placed in the strongest possible position for piers to be, that is end on, to the only sea that can affect them. Whereas those of Toronto would be placed in the weakest possible way to resist the sea, that is, broadside on, and would require to be doubly massive, compared with those of the former, to stand at all.

The interior effect of a Canal, two hundred feet wide and twelve feet deep, would be to create such a current through the Harbour, with a strong south-west wind from west to east, as to bring down the sands of the Bar into it, sweep those of the north margin of the Peninsula down upon the Canal and the east end of the Bay, whilst the evil consequences of some extraordinary gale could not be calculated. I think I have seen such a hurricane upon the Lake from south-west, as might render both channels unnavigable for a time.

The action of the current last season, the breach open about one hundred feet wide and two-and-a-half feet deep during a south-west gale, illustrated, upon a small scale, what would be the effect of a large opening and deep water, and amply confirms the opinions that I publicly expressed twenty years ago, when the subject of a Canal was then in agitation, that it would create such a current through the Harbour, whose bar and boundaries were composed of sand, as to prejudice the existing channel.

Nautically.—The Canal, if constructed, would be useless to sailing vessels in calms. With the wind off the land, it would be useless for entrance, but useful for exit to all vessels bound down the Lake. With the wind at S.W., and not stormy, it would be valuable again for exit, but for entrance from the east every nautical man would prefer making a stretch out into the open Lake, weathering the light at one long board, and rounding into the Harbour with a fair wind, to hauling through the Canal, coming in dead upon a lea shore, and having to beat up the Bay in short tacks. With the wind at south, it could only be used for entrance with the wind at north-east, and moderate, it would be useful to all vessels from the east, but useless to them for exit.

For steamers, to all bound inwards from the east, or outwards to the east, it would be useful in moderate weather. In high winds, either north-east or south-west, it could not be used.

Commercially.—There have entered the Port of Toronto last year, by the Harbour-Master's books, during the whole season for navigation, 2433 vessels of all sizes and classes, which include the daily steamers, and 1012 visits of wood and stone boats. Add to these 100 vessels in transit or weather-bound, not reported, say 2533 in all. Double these, upon the presumption that every vessel that comes into port goes out again, and say that 5066 vessels, in all, pass the entrances of the Harbour during the year. Now, taking every advantage of numbers, admit that one-half of the whole pass by Canal, or 2533 craft of every description. What toll would you put upon these vessels or cargoes to make the Canal *self-paying*, where the interest alone of the expenditure, at the lowest calculation, must be betwixt £3000 and £4000?

But take a view of it approximating to its true light, and say there are two entrances to the Port—the one tolled, and the other free. The tolled Canal would about share the fate of a turnpiked road, where there are two roads to the same place—the one a little round-about but free, the other taxed—the greater part of the traffic would go out of the way to avoid toll.

It is looking upon it in the most favourable light, to say that one half of all the vessels entering or going out of Port *could*, if they *would*, take the Canal. Deducting the Niagara, the Hamilton, the Port Dalhousie vessels, and nearly all the wood and stone boats, the casualties of wind and weather upon all vessels, and not one-fourth of the whole for entrance or exit, if both channels were free alike, *could* take the Canal.

Then there remains the only possible way of compensating for the large outlay of constructing and maintaining this Canal and another channel, that is, to make them both free alike, and resorting to compulsory Harbour dues upon all vessels or cargoes coming in or going out of Port.

What must be the amount of Harbour dues collected to pay interest on the capital invested in this Canal, reduce the principal, and maintain two channels to the Harbour instead of one?

Will it not be a great commercial disadvantage to a town like Toronto, surrounded by small Harbours, connected by railroad, and in close proximity to the rival Port of Hamilton, and hitherto enjoying light Harbour dues, and just relieved of all export dues, to be saddled with enormous charges, and those to sustain two bad channels instead of one good one?

What would the citizens of Hamilton give to exchange their costly Canal for the almost free Port of Toronto? With them it is Canal *or no Port*.

It may justly be asked, whence comes the desire to risk the stability of a good natural Harbour, by making another costly channel, which, at the best, can only benefit a partial navigation?

To the east end of the Town it can bring but evil, if it injure the west of the Harbour.

Is the entrance to the west of any benefit to the west end of the Town?

Are not almost all the commercial wharves east of Yonge Street? And is not Yonge Street the pivot around which all commerce centres?

Will any merchant ask, or care whether his goods come in at the east or at the west end of the Harbour, provided the Harbour charges be light? Will he consent to pay enormous Harbour dues merely for the accommodation of a partial navigation? In no other light can *commerce* look upon this project of a Canal. Lastly, as Provincial property, can there be a reasonable hope that any Legislature or Government will assent to the making of a second opening into one of the finest Harbours in the Province, at an acknowledged risk and heavy cost, unless an urgent necessity can be shown for such risk and such cost?

Until this vexed question is set at rest, the citizens of Toronto generally will not turn their attention with due anxiety to the preservation of the valuable Harbour they have the happiness to enjoy.

I have endeavoured to show, in the light I see it myself, that, physically, a Canal to the east would be destructive to the Port; that its nautical advantages are largely delusive; that it would act prejudicially on the commerce of the Town; and, lastly, that the assent of Government to such a project is all but hopeless. I will now turn my attention to a subject more worthy of the care and economy of a great commercial town like Toronto—the improvement of the Harbour, active steps of preservation of the main features of it, as traced out by the hand of nature, repairing that which is decaying, and improving without dangerous innovation such parts as are susceptible of improvement, is the only safe course that the guardian power of the Port can pursue. Like the human system, in all ordinary derangement, ordinary care may suffice, but where the danger is imminent, we call in the most skilful aid; so would I, in the important case of the derangement of any vital feature in the Harbour, consult the most eminent engineers, nay, a board of engineers, for no expense should be spared to secure the stability of a Port, upon which the value of so much property depends.

I, in the matter of the improvement of the Harbour, only give opinions founded upon long observations, and which observations may be useful to engineers; for it is only by observations on the present operations of nature, that we infer of the past, or anticipate for the future; therefore, in furtherance of my opinions and observations, although I did not mean to touch upon the theory of the formation of the Peninsula, yet as the means for its preservation call for some opinion of its origin to account for its present appearance, its constant state of transition however gradual, and to adopt measures to retard its decay, I here submit them.

The Peninsula is still fed by drift and detritus from the east, and still grows from the root whence it sprung, the point where the land falls away at the head of Ashbridge's Bay, striking out in a fair field of growth into deep water, the present formation, the result of ages of destruction of the highlands of Scarborough, even from the undefined time where the Lake changed its level from a higher to a lower, of which the whole boundaries of it bear incontestible evidence.

The action of the north-east storm has had the same effect upon the *then* advanced promontory of Scarborough, as the north-east storm has upon it at the present day. Acres and acres have been removed from the flats below Scarborough Heights within my recollection.

The result of ages of this work of destruction has been the formation of the present peninsula and shoal, the latter of which is upwards of a mile in width and six miles in length, the crest of it being the present Peninsula. If my theory be correct, the superstructure will be the gravel and stone of Scarborough flats, underneath of necessity *clay*, and below that most probably indurated clay. The crest has started in continuation of the land, with its broadest part above water, where now it is narrowest, for as the Peninsula extended west, and the Promontory of Scarborough receded from erosion, so did the neck of the Peninsula at the east, as it could not stand out prominent from the protecting land. Hence the more rapid retrocession of the Peninsula east, and the tendency to a Presqu-isle formation.

The proof of this retrocession of the Peninsula or crest of the shoal, is traced in the flat shelving shore, leaving little water as the crest recedes from the south, and meeting comparative deep water to the north, the Peninsula not being acted upon by the sea on that side. The modern marks of retrocession, within my own observation during the last twenty-five years, are the long line of aged trees undermined and thrown down by the sea all the way from the head of Ashbridge's Bay to Privat's Hotel.

On examining the beach on the inside at the head of Ashbridge's Bay, although the Lake has frequently make breaches there, and swept over the whole part, from where the trees cease east; increasing the beach inside, as it was swept from the outside; yet there is no such thing as that which we see at the breach in Toronto Bay; that is, two long piers of sand formed inwards, showing the range of current in; in Ashbridge's Bay there is no ready vent in an opposite direction for the bodies of water thrown in by the sea, consequently it returns in under-current again through the beach; hence no leading marks of a current, but augmentation of the beach within.

In Toronto Bay, the wide mouth of it affords rapid exit for the water as fast as thrown in, and hence the long banks of sand above water as leaders, and the mass ejected at their head into deep water.

It is easy to account for the spreading of the Peninsula tree-like to the west. The material being finer as removed from the source of supply, spreads over the lake, as seen by the turbid waters in all easterly gales; these gales are invariably met by a counter gale from the south-west, driving back the charged water upon the west end of the Peninsula and the mouth of the Bay, the reaction of the water from the Bay causes the deposit which forms the bar at the entrance. It is useless to speak of the phenomena of ridges caused by the action of the waves.

The Bar is now marked out by beacons nearly three quarters of a mile wide in the centre from the west beacon, east, and carries from three to six feet of water on the top, in ridges varying from three to six feet; over the whole top of this the sea ranges and it is encroaching upon the deep water of the Bay, for the sand shoots down from ten feet, where a buoy is laid on the slope, to fifteen and sixteen feet water almost immediately. No greater proof need be of the encroachments of the sand, and the resistance it meets by currents. This resistance has been reduced the last summer, and will be removed by every neglected breach, *and would be permanently so, to the ruin of the Harbour by a canal.*

The retrocession of the Peninsula is so gradual and uniform, that with due care no apprehension for the Harbour need be felt for a long series of years, unless neglect allow casual breaches to exist, which any extraordinary storm may occasion; then the evil is apparent, as witness the effect of the present breach into the Bay, a more rapid erosion and retrocession takes place.

The preservation of the Peninsula, it seems, rests with the city authorities; then the city authorities hold the responsibility and control the safety of the Harbour. With my opinions I should as soon think of leaving my fences down and my corn-fields open to the depredations of cattle, as expose this Bay for one season to the consequences of the inroads of the Lake.

The repairing of the Peninsula, maintaining it to a certain height and width, the soiling, planting and seeding it, to secure the surface against the action of the high south wind, will be improvements compared with the state of neglect to which it has been consigned since the hour that Toronto became a town. The thick growth of timber that the Lake spared has been plundered off it, and so little has the Peninsula itself been appreciated in its true light, that for the last few years it has rather been dealt with as an island of Guano, than as a barrier upon which the safety of the Port depended.

I was once of opinion that the bar should be raised above water by dyking, and the channel contracted from the Peninsula, but with the experience of Erie Harbour before me, where they have closed the entrance to a narrow channel by piers, it is more clearly demonstrated to me that the large body of water driven over the bar by the S.W. wind is more valuable in its reaction or undercurrent in resisting the encroachment of the bar upon the Harbour and coursing round through the channel, than if the same body of water were shut out and the maintenance of the current at the channel left to the mere varying levels betwixt the waters of the Bay and those of the Lake, and the small contributions from the Don. But be it understood that it is of *necessity* that there be no breach or outlet of water to leeward.

As to the shutting out the Don from the Bay of Toronto, that can no longer be thought of, as it would largely effect private interests, therefore it must be treated as an adjunct and made valuable to the Harbour. Not only should the entrance to it be cleaned out, but the whole of the bed of rushes entirely removed from the head of the Bay, and the water be allowed to flow freely in and out of the Don, the wave to beat upon the shore, and in a short time a clean beach would form all round the head of the Bay, leaving only the mouths of the Don to be bridged over.

The Bay is sufficiently large and contains surface enough to contribute to a great reaction during the prevailing S.W. winds in favor of the channel. It is ascertained that the water according to the wind fluctuates from one to four inches during 24 hours, by correct index in the centre of the Harbour, and that the Harbour contains a surface of nearly six square miles, that one inch rise or fall of water causes 144 cubic inches for every foot of surface to flow in or out of the Bay: that four inches rise or fall will cause one cubic foot, or one cubic yard in every three of surface to flow by the outlet of the Bay, in other words one-third of this surface water in cubic yards to flow by the mouth of the Bay, principally by the channel; but if the wind be strong S.W. a more rapid circulation is kept up by the water being blown over the bar, and dammed back from returning that way by the wind and broken water on it, it forces a passage by the channel.

If this body of water be allowed to traverse to leeward through a channel of 200 feet wide and 12 feet deep, which it certainly would; with such a sluice open, what is to retain the bar composed of moveable sand in its position, if, instead of backwater, there is a current over it, and through the Harbour from west to east?

It would certainly be an advantage to the Harbour if the system of considering it an arm of the Lake were extended to the head of Ashbridge's Bay, by making a wide opening of 700 or 800 feet past the mouths of the Don, through the cross beach, the rushes dredged away, and the winds and the waves allowed to play freely over the surface; this large circulation would benefit the Harbour and conduce to the health of the town, and the money that would be, unprofitably to commerce and injuriously to the Harbour, wasted upon an experiment, might have been applied with a better chance of profit. The whole of Ashbridge's Bay might, in the course of time, be converted into clear water and profitable land.

It is certain that the Marsh is both too valuable and too mischievous to be left much longer in the state it is in contiguity to a large populous and wealthy town like Toronto.

In looking to the channel I see no inconvenience likely to attend it, but through neglect of the means of preservation such as the dictates of science may point out.

The North point of the Bar progresses West at the rate of 19 or 20 feet annually. It has taken 22 years to advance about 400 feet, say it will take 50 years to progress Westerly 1000 feet, no further than Mr. Shanley has laid out in extent from the Queen's Wharf West, in his Report for an entrance to the town for the Toronto and Guelph Rail Road. We will presume as a matter of course also that the Harbour pier is carried West parallel with the advance of the point of the shoal 1000 feet in 50 years.

The buoys and beacons with flags on them show the shape and advance of the Bar, and it may be observed how it knuckles out abreast of the old head of the wharf, showing its effect on the shoal, the channel being 150 feet wider there than at the point West of it.

The channel has never yet been cleaned out since Toronto was a harbour. I think it ought to be, and if it was dredged to a depth of 14 feet in its best water when the Lake was at the lowest, that it would require no more looking to for at least ten years, probably twenty, as the longer the head of the pier, the more concentrated the action of the flux and reflux.

I cannot close this essay without claiming for myself larger and closer observations, and more devotion of time to the interests of the Harbour than has fallen to the share of many individuals for the last twenty-five years, and I trust my age, my experience, and

my long observations warrant me in making an urgent appeal to all the inhabitants of Toronto to appreciate the great value of their Harbour *as it is*. To oppose the stubborn bulwarks of common sense to delusive and costly projects of innovation which oppose the *operations of nature*.

There are but two natural Harbours on the North shore of Lake Ontario. These are Toronto and Kingston, Hamilton is only a port by means of its costly canal. Cobourg is entirely an artificial one, and one of continuous cost; Port Hope does and will owe all its haven properties to art and cost. Port Dalhousie on the other side has claims to that designation at great cost as the terminus of the Welland canal.

But Toronto, the very best Harbour on Lake Ontario, comprising an all but land locked basin, with a superficies of water of nearly six square miles in extent, possessing what no other port possesses, besides its safe basin within, *an excellent roadstead without*, a channel of easy and safe access, and moderate harbour dues: yet with all these advantages there is a suicidal call for speculative and dangerous innovation. It will be instructive to hear arguments in favour of this canal as beneficial to the Harbour in a *physical* and *commercial sense*, I speak not of the practicability of construction, for the science of engineering is equal to any task; but the advertisement that calls forth this essay is an invitation to constructing engineers to meet if possible the expressed and known wishes of a large portion of the inhabitants of this town, and the temptations to the undertaking of a work of such importance are very great. But the advertisement also calls for and challenges other opinions.

I, as an official of the Port, as an advocate for the safety and preservation of the Harbour, with a feeling of great interest for its commerce, with a knowledge that the value of ALL property in the town is based upon the stability of the Harbour as IT IS, oppose my opinion, grounded upon my long observations and much reflection, against those who advocate what in my opinion is a dangerous and speculative experiment.

It cannot be denied but that the Harbour good as it is, and may be for years and years to come, is one of gradual transition and decay. To preserve it, to improve it, to protract its decay, call in aid if needful the most eminent science, but touch not with a rash and speculative hand its *vital part*.

As a last appeal, and probably the last I shall ever make, I cannot impress too strongly upon those who hold property in the town to guard against all attempts at making a *second opening* into the Harbour. The integrity of the Peninsula is essential to its safety, upon it depends the stability of the Bar, and the flux and reflux to which the channel is due. *As long as the Harbour is as safe and as commodious for all the purposes of navigation and commerce as it now is to adopt the common sense and homely adage of "letting well alone."*

When this paper was written so far the breach at the narrows was open. It is now closed up, this is as it should be, and it behoves the guardian authorities now to raise the beach to a standard height above the reach of the wave sufficient to guard against future evil.

I have no interests to serve but those I ought to serve, the safety of the Harbour, and the interests of navigation and commerce. Now, that the Peninsula is intact from end to end, keep it so. If any engineer can be found to assert that a body of water can come in at one end of the Harbour, and go out at the other without current, or that a current can pass over sand without affecting it, it will be an anomaly worthy of explanation. For certain purposes it is convenient to treat the present channel, much as the Czar of Russia treats the Turkish Empire, that it is *sick* and *ought* to *die* for the benefit of others. But I here assert, and I am willing to subject that assertion to the test of the most experienced engineer or to be examined upon it by a board of engineers, that *as long as the Peninsula is maintained intact, and as long as there is surface water in the Bay that the last drain of it will pass by the channel.* Neglect in extending the pier coequal with the march of the shoal may allow the water to flow over less navigable bottom, but as long as this is attended to, and the pier carried West, so will the channel be good, even unto the Humber Bay, which will not be for some generations yet to come. As long as the same phenomena of winds and currents exist as now, the guardian powers of the Harbour must be guided by *their past* and *present effects* to calculate on the means of its *future preservation*.

I have the honor to be,

Gentlemen,

Your most obedient servant,

HUGH RICHARDSON.

Toronto, 1854.

EXTRACT FROM THE MINUTES OF THE HARBOUR COMMISSIONERS.

Moved by MR. THOMPSON, seconded by MR. HARRIS,—

That, inasmuch as it is a matter of doubt whether the Harbour Master, being officially connected with this Board can, with propriety, be allowed to compete for the premiums to be awarded for the three best reports on the Harbour, the Commissioners are of opinion, that Captain Richardson's Report should not be considered as in competition with the other Reports that have been sent in.

The Commissioners, however, are decidedly of opinion, that had no such objections existed, Captain Richardson's Report would have been entitled to stand as second. The Board therefore decide that the sum of £75 should be awarded to Captain Richardson from the funds of the Harbour Commissioners; as an acknowledgement of the very great merit and the amount of information contained in his Report.—*Carried.*

(Signed), J. G: CHEWETT.

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